ENGINEERING NEWS

Tribune Building, New York City.

GEO. H. FROST, PROPRIETOR.

SATURDAY, JULY 23, 1881.

OBITUARY.

Just as we go to press we are in receipt of the sad intelligence of the death by typhus fever, at Rio Janeiro, on the 14th inst., of Col. W. Milnor Roberts, past President of the American Society of Civil Engineers, and late Chief Engineer of Public Works of Brazil. Col. Roberts is too well known to our readers to need any but a brief sketch of his life in these columns at this time. From a very complete history of his professional career, published in *Engineering News*, Jan. 11, 1879, the week subsequent to his departure for Brazil, we give a few particulars.

Col. Roberts was born in Philadelphia, Feb. 12, 1810. His aptitude for mathematics early introduced him to the then new profession of civil engineering, and in the spring of 1825 he received his first appointment as a chainman of the Union Canal, of which Canvass White was Chief Engineer, and Sylvester Welch, Locating Engineer. At 18 years of age he was appointed engineer in charge of the most difficult division of the Lehigh Canal, from Mauch Chunk down, sixteen miles, and from that time forward he was always intimately connected with great canal and railway enterprises, principally in Pennsylvania and New York States, with intervals in Brazil, and in the Western States. He held important offices under the United States Government, was Chief Engineer of the Northern Pacific Railway, Associate Chief Engineer of the St. Louis Bridge, and an active and important member of the Mississippi Jetty Commission. In 1879, shortly previous to his departure for Brazil, Col. Roberts was elected President of the American Society of Civil Engineers, a society of which he was a very active and always interested member, and which will very keenly feel his loss. Though so far advanced in years Col. Roberts was an unusually active and energetic man, and some idea of the extent and difficulty of his labors in Brazil may be gathered from letters which have been published in this journal during the past two years. Col. Roberts was possessed of a most genial and kindly disposition, and the news of his death will be received with feelings of great sorrow by the entire profession of which he was a member, as well as by a very large list of friends in this and other countries where he was known.

THE OUTLOOK FOR ENGINEERS.

The great activity in the building of railroads which has prevailed during the last two years in this country, and in other lands where American capital has control, has naturally very favorably affected the engineering profession in all its branches. The railroad companies themselves and all the industries chiefly dependent upon them have prospered, and full employment has been given to those whose professional services are so much needed directly and indirectly. The hard times following the year 1873 are forgotten, and many engineers appear to look into the future with the brightest hopes. We trust that their expectations will be realized, and that experience and business tact will secure for them a satisfactory and permanent occupation. But, however favorable special circumstances may make the position of a few, there can be no doubt that the majority, especially of the younger engineers, must submit to the inexorable law of trade, of demand and supply. Even those who believe themselves out of the reach of its operations are more affected by it than they may be able to perceive; while a press of unemployed engineers may not in any way imperil their position, it is very likely to check an improvement of it.

The relations between every branch of society and the whole are so intimate that the well-being of one is dependent upon that of the other. We are now in a period of exceptional prosperity. Capital is abundant and by no means cautious, and agriculture, industry and commerce have reaped ample returns. This has been reflected in the condition of our modern highways, the railroads, and we have seen them expand at the rate of 7,000 to 7,500 miles per annum during the last and in the present year. Much of this vigorous development has been healthy and, until now, purely speculative schemers have not been abundant. Their number is, however, increasing now at a suspicious rate, and the indications that the knowing ones are beginning to "stand from under" are multiplying. There can be no doubt that there has been much over-speculation and that a reaction must follow in the natural course of events. The question how far it will extend and whom it will effect is an interesting one. There are many things which tend to show that the impending crash will be far from approaching in its severity the crisis which followed 1873. It will only involve those who have been over-discounting the future too heavily. The alarm of short crops here and full harvests abroad is much exaggerated, and legitimate, substantial business, industry and commerce have little to fear from a reaction against the prevailing speculation in old and new railroads and similar enterprises. The latter, however, will receive a very severe blow. Many of the schemes now on foot will collapse entirely. Other projects and extensions will be pushed with less vigor. It is impossible, after a calm survey of the present situation and the probabilities which it holds out for the future, to escape the conclusion that the good times which the promoters of railroad enterprises and all of those connected with them are now having, can not last very long. A period is rapidly approaching when many of the most enterprising and ambitious will abandon a profession which does not hold out to them the promise of returns in fair proportion to the efforts made. We are far from underrating the fact that engineering holds out prizes great enough to satisfy the most ambitious, but it is our desire to point out impending changes and urge upon the individual the necessity of facing the future squarely and choosing in accordance with a general survey of the outlook, modified by the special features of each case. A period of dullness in a profession does not, necessarily, imply a process of "natural selection." True, many of the weakest will go to the wall, but many of the "fittest" will abandon the field in search of better ones. To the former we have little to say; the latter will find ample room in which the peculiar training of an engineer will aid to conquer a position of trust and profit readily.

NEW YORK AND BROOKLYN BRIDGE.

(*Continued from page* 288.)

"The engines used on the work, aside from those spoken of, were of two kinds. In the first, an end friction on one end of the drum was used for throwing in gear, in place of a clutch, and the lowering was done by a strap-brake at the other end of the drum. These worked with entire safety, but the descent of a stone in setting could not be governed so well as with the other style, which had a clutch on the driving shaft for throwing in gear, and a strap-brake on the drum for holding the load. Most of these had two drums each, worked by a cylinder 8 in. in diameter and 10 in. stroke.

"For all ordinary weights, with four-fold purchase, 85 pounds of steam were sufficient; but loads of seven to nine tons, steam was frequently carried at 100 pounds; particularly when the hoist was up to 80 ft. The lowering and setting (the second type of engine was used at the anchorage for this purpose) with these was done by shutting off steam, and opening to a greater or less degree a small escape-cock connected with the valve-chest. With the descending load, the piston then acted as an air pump, and the speed of descent depended entirely upon the quantity of air allowed to escape.

ARRANGEMENT OF WORKS.

"From the very outset on this work, the fact that steam power is cheaper than hand labor has been kept steadily in view. At the stone yard, the 15 derricks mentioned were so arranged that all could be worked by steam, and a series of narrow-gauge tracks were laid so that the stone could be brought to them on small stone cars with the least possible labor.

"At the towers and anchorages the permanent tracks were of ordinary gauge, 4 ft. 8½ in., and turn-tables and switches put in where required for convenient working. The advantages of the wider gauge were, greater freedom from danger of upsetting a car with a heavy load, and also in Brooklyn, the saving made by using the street car tracks for the distance of a block. Until the masonry of the New York tower reached high water, there were two tracks extended directly over the work to about the middle points between the derricks. These were suspended on cantilevers, so as to be entirely free from the work below, and proved a great convenience. The tracks to the anchorages were made double (except in Water street, New York, which was too narrow), and curves were put in wherever observation showed that by so doing any obstruction of frequent occurrence could be avoided, such as trucks unloading at a bonded warehouse. On the New York side, the anchor plates, measuring 16×17½ ft. and weighing 28 tons, were transported from the dock to the anchorage over these tracks. Each plate was suspended between two cars on a simple framework of timber about 30 ft. long, the cars acting as bogies. The curves in the track, one of which was of 84 ft. radius, were greased, and with two teams of horses the plates were each hauled to the anchorage 1,000 feet distant, in from one and one-half to two minutes.

ACCIDENTS.

"As is sure to be the case, these always happen when least expected, and at some weak point which has been overlooked. A system of daily inspection of derricks was instituted at the start and kept up to the end of the works. This was intrusted to the foreman in charge of the riggers, a man of large experience. Aside from failures already mentioned, there were several cases of straightening of hooks of blocks under heavy loads. These were in every case only after long-continued use, and evidently after the iron had been repeatedly strained beyond the elastic limit. In one case, with fortunate escape from serious consequences, a leading block on a derrick split. In another case the heel of an unloading derrick—framework and all—slipped on its bed. Several serious accidents, all the result of carelessness of those injured, occurred to men guiding falls on engine drums. One or more occurred from defective strap-brakes, the woods having worn so as to prevent a proper tightening. One occurred from the careening of a balance derrick, owing to the improper removal of the blocking underneath, and one or two from overbalancing. It should be stated here that the derricks were raised 4 ft. at a time, and supported in blocking, which was removed piece by piece, as stone setting required.

"The limestone first received was lewised with round lewises. These were found to be unsafe, but not until one or two serious accidents had resulted, by stone so lewised falling when swinging over the work. In all subsequent contracts it was specified that flat lewises only should be used. The size adopted was such that the portion entering the stone had a a united area for the three parts of about 4 in. bottom width, 3 in. top width, and entering 4 in. into the stone, with a thickness of ¾ in. These, when properly driven, never pulled out, with any hoist up to 80 ft. But when very heavy pieces of granite were taken to the upper portion of the tower, the surging would sometimes crack out a flake of stone, 1 to 2 ft. wide. But one stone actually fell from this cause (from a height of 200 ft.), but in several cases the flake came out, on removing the

lewis. For this reason, a still larger lewis was used afterward on the heavier stones of from nine to eleven tons weight.

"Most of the serious accidents to men occurred from falling. One fell from a gang-plank by allowing his wheelbarrow to pull him off, and several lives of men working on the towers were lost by a misstep. The force of the wind near the edge of the tower was often very great, and coming as it did, in sudden puffs, it became a source of great danger.

SIGNALS.

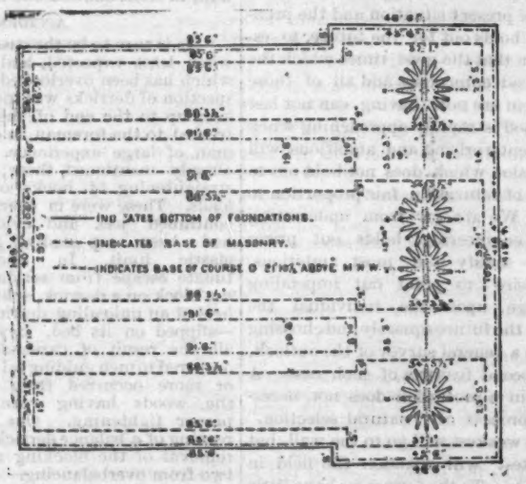
"At such a height as that of the towers, it was often difficult to make the men who were below understand signals from those above. This became a source of real danger in hoisting heavy stone, as the top of the tower was frequently enveloped in mist, so as to almost hide it from the engineer. The wind and other noises would often drown the voice, and at times a sharp whistle was heard but faintly. Bell wires were tried, but were so liable to become deranged that they were sometimes sources of danger. By great watchfulness, the cases of overwinding were rare, and no serious results followed. The safest signal was a flag, held well out, and the motions positively made, so as to be unmistakable if seen at all. A whistle was also used as an additional safeguard.

ANCHORAGES.

"These rest on timber foundations, with the spaces between sticks two to five inches, and filled with concrete. The extreme dimensions of the Brooklyn anchorage foundation are, 119 ft. 4 in. by 132 ft. It is 4 ft. deep, its base reaching to tide level, and the whole being constantly wet by water in the sand. The excavation was from 20 to 25 ft. deep, and the foundation rests on a uniform bottom of fine sand.

"The New York anchorage has a similar foundation, 119 ft. 4 in. wide, but extended at the front so as to be 138 ft. long. This change was made on account of the character of the bottom across the front edge. The ground here had been filled in, and the excavation was continued until a uniform bottom of clear sand and gravel was reached over the whole surface. The foundation is all below tide, and has a depth of 4 to 7 ft.

"The masonry of the Brooklyn anchorage, therefore, stands at 4 ft. above tide, and that in New York at high-tide level. The anchor plates in Brooklyn have their upper surface at 8 ft., and in New York at 6 ft. above tide. The general plan of the anchorages is here shown.



"The walls, both outside and in the main tunnels, have a batter of ½ in. per foot rise. The exterior measurements of the cornice are 124 ft. by 111 ft. 8 in. at rear, and 101 ft. 8 in. at front. The main tunnels are arched over by semi-circular arches of 23-ft. span, springing at 62 to 66 ft. above tide. The rear tunnels have vertical walls, and are arched by semi-circular arches of 14-ft. span. These were not a part of the original plan, but were inserted to give means of communication from front to rear.

"For 29 ft. above tide in Brooklyn, and 23 ft. in New York, the stones, except over the anchor plates, are all limestone, with rock face pitched to a line on the arrises. At these heights there is a 10-in. offset carried around all the faces except those of the rear tunnels, and above this the corner stones at each exterior angle are of granite. The corner stones have a bold chamfer, 4 in. broad, cut entirely around each face, except at the projecting corner. The faces between the chamfers have a draft 1½ in. wide cut around each, and the surfaces between pointed to 1½ in. projection. The limestone has the same finish throughout as at first described. The cornices are of granite, corresponding in detail to those of the towers.

"The New York anchorage contains 28,808 and the Brooklyn anchorage 27,113 cu. yds. of masonry.

"The anchor bars start from each plate in double sets, one curving over the other. They are vertical for about 25 ft., and then curve about 90°, so that the radius of a circle through the lower pins is 49 ft. 6 in. From this point they extend to within 25 ft. from the front edge of the masonry, where the cables are attached. The links of the first three sets have a section 7 by 3 in.; the next three, 8 by 3, and the next three, 9 by 3 in. The tenth set is double in number, and each 1½ by 9 in. The total weight in each anchorage is about 1,000,000 pounds. At each knuckle of the chains a large piece of granite is set, with a heavy cast-iron plate inserted as a bearing for the heads of the links.

"Aside from these bars, there are heavy bars inserted for attaching the cradle and foot-bridge cables, for attaching the wind-guys and minor irons for temporary work.

"The work of excavating for the Brooklyn anchorage began Feb. 15, 1873. The foundation was completed and the first stone laid June 26. Work stopped Nov. 29, at 27 ft. above tide. The approximate cost of the season's work, for 8,334 cu. yds. of masonry laid, was $18 per cu. yd., of which $18.34 were for stone.

"Work began again June 11, 1874, and continued until Dec. 29, reaching 61 ft. above tide; it was again resumed April 6, 1875, and was completed as far as practicable till after cable making, Oct. 1, 1875, a total of 34,132 cu. yds. having been laid.

(TO BE CONTINUED.)

PERSONAL.

A. B. Chaffee and P. A. Peterson, Montreal; W. T. Hunt, Boston; E. Gordon, Hyde Park, Mass.; and John A. Duggan, Quincy, Mass., have applied for letters patent of incorporation as the Dominion Safety Switch Company.

The board appointed by the Secretary of the Navy for the examination of candidates for appointment as civil engineers in the Navy will convene at the Navy Department Aug. 10 instead of Sept. 1, as at first ordered.

Judge John F. Dillon has been appointed receiver of the Manhattan Elevated Railroad Company, of New York.

Mr. Harry E. Blake has resigned his position as Assistant Engineer in the West Point Tunnel of the New York, Ontario & Western R. R. to accept the position of Division Engineer in the Cincinnati & Southeastern Railway, with headquarters at Newport, Ky.

On July 6 a party of surveyors on the Mexican Central line were attacked by Apaches about 40 miles south of El Paso del Norte, in Mexico, and severely handled. All of them escaped, however, except five, Charles Greene, of Independence, Kan.; Larry Fordham, of Boston; Guy Leavitt, of Indiana; George Wallace of Taylorsville, Ill.; and Charles Haines, of Kan. The men were shot down and killed by renegade Apaches while running from the wagon. The bodies were found nude and badly decomposed, and were buried on the spot.

The Springfield *Republican* says: "The death of Carl O. Wederkinch in Honduras removes a civil engineer of reputation and great promise, and a man warmly esteemed by many friends in Western Massachusetts. The career of this young Dane illustrates the possibilities of American life, and makes an interesting and instructive story. Like Carl Schurz, Mr. Wederkinch landed at New York with no knowledge of English; he had taken a $200 prize at the university in Copenhagen, which, according to its conditions, must be spent abroad. He could find no employment at engineering, and, in straits, drifted to Boston and began at the bottom of a machine shop; then was employed by an instrument maker; at last, having in the meantime mastered English, succeeded in gaining a subordinate position on the Hoosac Tunnel engineering corps. He made all these circumstances contribute to his growth, maintained a steady and sunny confidence in himself, and in the most difficult and hazardous post on the Hoosac Mountain, the work of sinking the central shaft, achieved a splendid reputation. He patented many valuable inventions, and was a remarkable instrument maker, doing his own fine work. His original devices and accurate work secured the engineering success of the central shaft, and led to his appointment as Chief Engineer of the Sutro Tunnel. After making a good record in Nevada, his attention was turned to mining, and he studied the subject carefully, taking a course in the Columbia School of Mines at New York. He made good investments in Nevada, and at his death was superintendent of silver mines in Honduras. He was apparently certain to add wealth to brilliant professional achievements when death came at 35."

Lieut.-Col. Nathaniel Michler, of the United States Army, died at Saratoga Springs on Sunday. He was born in Easton, Pa., his father being Peter Michler, owner of one of the finest estates in that portion of Pennsylvania. Nathaniel Michler entered the Military Academy at West Point, July 1, 1844, and was graduated July 1, 1848. He was then breveted a second lieutenant of topographical engineers. He served as Assistant Topographical engineer in making surveys and reconnoissances in Texas and New-Mexico in 1848 and 1851, and on the Mexican boundary survey from 1851 to 1857. With the rank of second lieutenant, he was Chief Topographical Engineer in charge of surveys of the Interoceanic ship canal from the Gulf of Darien to the Pacific Ocean. He was promoted to the rank of First Lieutenant of Topographical Engineers, May 19, 1856, and was the topographical engineer in charge of running the boundary line between Maryland and Virginia from 1858 to 1861, and later was light-house engineer of the Pacific Coast. He was made a Captain of topographical engineers, Sept. 9, 1861, and did good service in the departments of the Cumberland and of the Ohio up to June 1, 1863. He participated in the various movements, battles and engineer operations in these armies, and while en route to join the Army of the Potomac was captured near Rockville, Md., and paroled. From July 24 to Sept. 18, 1863, he was engaged in the survey of Harper's Ferry and vicinity, and in constructing defenses on Maryland Heights. He took charge of the Topographical Department of the Army of the Potomac Sept. 30, 1863, and was made Major, Corps of En-

gineers, April 22, 1864. He took part in the battles of Spottsylvania Court-house, battles and actions of Cold Harbor, siege and battles of Petersburg, and other engagements, and was breveted a lieutenant-colonel Aug. 1, 1864, for faithful and meritorious services in the field. He was breveted a colonel April 2, 1865, for gallant and meritorious services during the siege of Petersburg, and on the same day was breveted a brigadier-general for gallant and meritorious services during the rebellion. He was present at the capitulation of Gen. Lee with the Army of Northern Virginia at Appomattox Court-house, April 9, 1865. After the close of the war he was engaged in selecting a site for a Presidential mansion and park and in making preliminary surveys and drawings. He was a member of the board to prepare plans, specifications and estimates for new War Department buildings, and later was acting Commissioner of Public Buildings at Washington.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 265.)

XXXVIII.—HARTFORD.

Hartford, Conn., is on the west side of the Connecticut River, 60 miles from its mouth, in lat. 41° 45′ 59″ N., long. 72° 40′ 45″ W.

Along the river there are large tracts of level land, portions of which have been dyked to prevent flooding. Further back the ground is high.

Settled in 1635, the population in 1854 was about 20,000, when water-works were constructed by the city, taking their supply from the Connecticut River opposite the city. From a stone inlet pier in the channel, with an opening 4 ft. below low water mark, a 24-in. iron pipe 140 ft. long leads to a well 6 ft. in diameter, outside of the engine house. The pumps are 10 ft. above water level, and 25 ft. distant from the well, and lift the water 125 ft. to the reservoir, through 6,879 ft. of 16-in. pipe. The engine, built after plans of William Wright, was a condensing beam and fly-wheel engine, with steam cylinder of 32-in. diameter and 60-in. stroke, with 4 bucket and plunger pumps of 19-in. diameter and 16½-in. stroke, worked by cams on a shaft geared to the fly-wheel shaft. The pumps have since been increased in size.

In 1864, the engine being overtasked, a large air chamber was added. This engine is on duty at present time, and though it has not been used constantly since the erection of the gravity works, yet every year it has been called upon for considerable service.

The reservoir at Asylum Hill, connected with the pumping works, of 8,000,000 gallons capacity, was by mistake, in original plans, quite inadequate. It is in embankment and excavation, with puddled walls.

In April, 1879, the waste gate of this reservoir was opened by some unknown person, and it was suddenly emptied and the slope walls slid into the reservoir. It was repaired.

In 1865–7 gravity works were built at West Hartford after plans and under superintendence of George Marsh and Samuel M. Gray. Water is taken from a mountain stream known as Trout Brook. An earthen dam 53 ft. high, 782 ft. long, was built, flowing 32 acres with a capacity of 165,000,000 gallons. The elevation of flow-line above low water in river is 260 ft. In September, 1867, a heavy fall of rain occurred, breaking away a partly constructed dam above, and washing the banks of this reservoir badly. The water, rising above the puddle wall in the dam, cut a channel over the top, and in 20 minutes the dam went down, sending 200,000,000 gallons of water into the valley, causing much damage. The dam was rebuilt under the direction of J. W. McAlpine, and finished by December of the same year.

In 1874 the waste way of this reservoir was widened to double its capacity, and an overflow of masonry near the outlet, with 1-foot flashboards. This reservoir is called No. 1.

Another reservoir, called No. 3, was completed in 1869 with banks left sufficiently wide to be raised 5 ft., which was done in the following year. It has a capacity of 297,000,000 gallons.

In 1875, a reservoir called No. 4 was built on Trout Brook, above No. 3. A dam of earth was thrown across the ravine. A puddle trench, 25 ft. wide, is sunk to the rock 19 ft. below the bed of the stream.

The dam is 170 ft. long at the bottom and 560 ft. at the top. The extreme width at the base is 225 ft., at the top 30 ft., and at the top water line, or 5½ ft. below top of bank, it is 50 ft. thick. It is 42½ ft. high above the bed of stream. The inside slope is 3 to 1, covered with rip-rap 30 in. thick. The outside slope is 2 to 1 and sown with grass. The waste way was cut through to a small ravine, which joins the main stream 300 ft. below the dam. The 16 and 20-in. discharge pipes also enter this ravine. Near the upper end of the reservoir a dyke 6 ft. high and 310 ft. long separates the water from the water of Mine Brook Valley. A second dyke 125 ft. long and 4 ft. high separates the water of the reservoir from dyke pond lying between reservoirs No. 4 and No. 3. There is a 12-in. connection pipe through this dyke and into reservoir No. 3. About 6 acres of muck at the upper end of the reservoir were covered with gravel 3 ft. deep.

This reservoir (4) flows 25.42 acres, and has a capacity of 154,524,829 gallons. Its extreme length is 2,890 ft., and average width 380 ft.

In 1877 the dam of this reservoir leaked, and was repaired by drawing off the water and laying a strip of puddle wall along the bottom of the dam, inside.

In 1880 a reservoir was built after the plans of W. E. Worthen, C. E., in a ravine into which empties Caldwell and another small brook. It is known as the Coldwell or No. 2 Reservoir. The dam is an east embankment, built in 6-in. layers, well watered and rolled. The surface was excavated to hard rock, and a concrete heart wall built, and the remainder of the trench filled with puddle. This reservoir overflows 160 acres. Two 20-in. pipe lines lead through the dam, one for waste and one for supply. There is a masonry gate-house on the inside slope. The main dam is 1,450 ft. long. A second dam 700 ft. long was built to prevent the water from backing across the divide at the upper end. An open conduit and 561 ft. of 16-in cement pipe lead the water to reservoir No. 1, a distance of 15,840 feet.

The first conduit from Reservoir No. 1 at West Hartford was of 20-in. wrought iron and cement. This pipe lasted from 6 to 10 years. The Water Commissioners in 1876 reported that it was rapidly being replaced with cast iron. It was found that the cement separated from the iron, which oxidized rapidly, and the joints caulked with hemp also proved very leaky in soft ground.

From time to time the W. Hartford works failed in supply, and pumping from the river was resorted to.

In 1875 a new 20-in. cast-iron main was laid from the W. Hartford works to the city.

The distribution was at first largely by cement and wrought-iron pipe, but in 1875 their further use was abandoned and only cast-iron pipe are now used.

The total length of pipe laid to March 1880 was: Cast-iron 54.9 miles, wrought-iron and cement 15.7 miles, of which about 9 miles are less than 6 in. in diameter. There has been no regular division into high and low service, but the old river works supply when running only the lower part of the city.

The first 20-in. main crossed the river on the old wooden bridge. When this was taken down in 1869 the main was supported temporarily on piles. On the completion of the stone arch, the pipe was carried across it on wooden supports.

The population, pipeage and consumption every tenth year have been as follows:

	Population.	Miles of pipe.	Consumption in million gallons.
1860	30,000	30.1	0.78
1870	37,180	46.4	....
1880	42,553	70.6	4.50

In 1880 there were 4,904 service taps, 362 fire hydrants, 54 meters.

The use of meters was begun in 1877.

The cost of the works to 1880 was	$1,497,408.25
Repairs and mainteanance	485,475.93
Interest	959,521.15
Total	$2,942,405.33
Income from water rents	$1,635,626.91
Bonded indebtedness	1,052,000.00

The works are controlled by a board of six Water Commissioners. Horace Bissell was President and Superintendent from 1867 to 1872; Seth E. Marsh was President, Superintendent and Chief Engineer from 1875 to 1878. Since 1878 Edward J. Murphy has been President and Superintendent.

XXXIX.—LYNN.

Lynn, Mass., is in lat. 42° 6′ 27.5″ N., long. 72° 35′ 12″ W., on the north side of Massachusetts Bay, along the shore of which for three miles the city extends, mostly on flat land, with salt marshes in front of it, and behind it, about a mile and a half from the shore, a range of hills, a spur from which advances into the heart of the city, rising to a height of 185 ft. Settled in 1629, it was incorporated as a city in 1850, with a population of 14,257.

In 1869, after a disastrous fire, a line of pipe was laid from Flat Pond to the centre of the city, about 2.5 miles, and a number of fire hydrants set. A Worthington engine was used to obtain fire pressure. This engine has been removed to the present engine house as auxiliary to the main engine.

In 1871, the population being 30,000, water-works were constructed by the city, under the direction of five commissioners, George H. Bishop being the chief engineer.

The supply is taken from Breed's Pond, at the confluence of two brooks which receive the drainage of about one square mile of steep, rocky hillsides. The first storage capacity was 150 million gallons, which was increased by 40 million gallons in 1878, by raising the dam 3 ft.

In 1873, a storage reservoir was constructed on another stream by building an earthen dam 210 ft. long and 16 ft., flooding 67 acres and storing 200 million gallons. This is called Birch Pond.

The water is conveyed from the ponds to the engine house by 20-in. wrought-iron and cement pipes, and is pumped by a Leavitt compound beam and fly-wheel engine with steam cylinders of 17⅛ in. diameter for the high pressure, and 36 in. for the low-pressure working a Thames D tton pump, with bucket of 26.12-in. and plunger of 18.5-in. diameter, the stroke of pistons and pump being 84 in., and the capacity of the pump, at 18 revolutions of engine, 5 million gallons per day. The water is lifted 164 ft. through a 20-in. wrought-iron and cement pipe 1,904 ft. long into the distributing reservoir on Pine Hill, which is built in excavation and embankment, with five acres of water surface at 177 ft. above mean high tide, and a capacity of 20,000,000 gallons at 15 ft. depth. The bottom, being of apparently water-tight material, was not puddled, and when the reservoir was filled it leaked so badly as to be almost useless. In 1873 the bottom was excavated 3 ft., and then covered with a foot of clay puddle. The reservoir was also divided into two parts by a wall of stone with a puddle core. On being refilled, it leaked slightly at first, but gradually be-

* Copyright 1881.

came tight. During the repairs to the reservoir the force main was connected with the distribution pipes, and the engine run continuously at slow speed.

The distribution pipes are of wrought iron and cement; 57.28 miles were in use in December, 1880, a mile and a half of this being in the adjoining towns of Swampscott and Saugus, which pay for the pipe and also pay the city current rates for the water they use. A larger proportion of 4-in. pipe is used than is common now.

There are in use 4,488 taps, 411 fire hydrants and 121 meters, only one of which is on a private dwelling. The population in 1880 was 38,284, and the consumption 1,238,289 gallons per day.

The total cost of construction of the works to Jan. 1, 1881, was $1,084,234.85, and the revenue had been $586,673.32. The bonded indebtedness is $921,500. The annual income to December, 1879, was exceeded somewhat by the cost of maintenance and interest. For the years 1879 and 1880 the income exceeded all expenditures by $30,-140.08.

The sources of supply are becoming inadequate to the demand, and the Water Board desire to take water from other ponds. By order of the Common Council, an experiment was made in 1880 to test the supply procurable from the ground water in the western part of the city by tube wells. Twenty-eight pipes of 1¼-in. diameter were driven from 31 to 69 ft. into the ground on the margin of Strawberry Brook, the outflow of Flax Pond, at the point where the stream meets tidewater. The walls were driven through a clay stratum, which was from 1 to 34 ft. thick, and lay from 2 to 20 ft. below the surface, and is underlaid with saturated gravel. At three of the wells no clay was found. All of them were flowing wells. They were all connected with a Knowles pump of 18-in. steam cylinder, 12-in. water cylinder and 24-in. stroke. Pumping was begun on Sept. 4, and continued without intermission. The reports up to March 1, 1881, show that the average daily yield for six months was 416,530 gallons, that the yield gradually diminished, that the average lowering of the water table, as shown in wells 1,500 to 2,000 ft. distant, was over an inch a day, and that the quality of the water was deteriorating regularly. Comparing the cost of pond water with driven well water, the interest on the cost of Breed's and Birch ponds, and the conduits connecting them with the engine house, is equal to $18.70 for each million of gallons drawn from them during seven years, while the cost of pumping and interest on plant of the wells is $28.42 for each million of gallons obtained from them.

The works are managed by a Water Board of five members. Daniel Walden has been the superintendent since the construction of the works.

XL.—GRAND RAPIDS.

Grand Rapids, Michigan, is at the head of navigation on Grand River, 30 miles east of Lake Michigan. The river at this point has a fall of 17 ft. in two miles, affording a valuable water power.

In 1840 a company, incorporated as the Grand Rapids Hydraulic Company, began bringing water from hill-side springs to the town in wooden logs. Their works were extended from time to time. In 1857 a line of iron pipe was laid. In 1861 a brook rising in large springs known as "The Penney Eighty" was incorporated in the supply. In 1864 a reservoir was built near the head of this brook. In 1870 additional connections were made with hill-side springs. In 1872 a well was sunk. A circular wall of brick bound with iron was built on an iron shoe with a cutting edge, the interior earth was dredged out and the wall allowed to settle by its own weight. This was carried to deep gravel strata. It is plastered inside and out with hydraulic cement, so that only water from the lowest level finds entrance. There has always been a greater demand than this company could supply, the quality of the water being excellent. The company erected free pen-stocks which supplied a large part of the population. In 1875 had 8 miles of pipes. In 1873-5, the population being 30,000, works were constructed by the city after plans of Peter Hogan, C. E.

Water is taken from Carrier Creek and Cold Brook, two small streams. The average daily flow of the former is 818,444 gallons in 24 hours; of the latter 999,926 gallons in 24 hours.

In 1874 a temporary fire supply was furnished by a Worthington duplex high-pressure engine with steam cylinders of 8½-in. diameter, water cylinders 14-in. diameter, the stroke of both being 10-in.

In 1875 a direct acting condensing fly-wheel engine was erected (built by Butterworth & Lowe), with steam cylinders of 33-in. diameter and 72-in. stroke. The pump is 14½-in. diameter and 72-in. stroke, air chamber 3½-ft. diameter and 15 ft. high. Capacity of 16 revolutions per min. 2,300,000 gallons in 24 hours.

In 1879 the engine was duplicated and began running in 1880.

In 1874 a distributing reservoir was built. It is circular, 196-ft. diameter at the bottom and 271-ft. at the top of banks. It is 25 ft. deep, the depth of water being 20 ft. It is in excavation and embankment. The bank is 12 ft. wide on top and has inner slope of 1½ to 1 and outer slope of 2 to 1. The bank is built mostly of sand, with a puddle in the centre along the natural surface and over the bottom.

The inner slope is paved with cobble-stones 1 ft. deep, laid on a foot of concrete, the upper two feet being paved with 6 in. cobble-stones set in gravel. On the bottom is 8 in. of concrete, and on this 8 in. of cobble-stone pavement. The capacity if 6,000,000 gallons and the flow line 177 ft. above the Grand River at Fulton st. It has never leaked.

The force main is 16 in. in diameter (iron pipe) and the effluent pipe 20 in. They are carried under the embankment, the joints being inclosed in masonry piers. The force main ends in a mass of masonry at the foot of the inside slope, and the effluent pipe takes its supply from a small masonry well and screen at the foot of the inside slope.

In 1875, a storage reservoir and settling basin was built where Cold Brook and Carrier Creek approach each other. The basin is of irregular shape, with seven sides, from 33 to 356 ft. long. The area at the water line is 1.85 acres. The soil is impervious clay, and the slopes are lined with dry stone. It is in excavation and embankment.

The waters of the two creeks each enter it by a 20-in. cast-iron pipe. At the lower end is a dam of masonry, 50 ft. long, 23 ft. wide and from 3 to 18 ft. high. The water passes through a channel 4 ft. wide and 32 ft. long between retaining walls to an outlet chamber of stone masonry, from which a 20-in. supply pipe, 133 ft. of which is cast iron and 1,860 ft. of pine staves banded with iron, leads to the pump well.

The distribution is by means of the "Wyckoff Patent Wooden Pipe" and bored pump logs, the latter used on the higher levels. The Wyckoff pipe is made of sound, well-seasoned, white pine logs in 8 ft. lengths. They are bored to the required size and turned to a 3-in. shell. A spiral band of hoop-iron is wound around them fastened at the ends with 3 turns and riveted with copper rivets, the bands being covered with asphalt. The joints are made with a wooden thimble. They have been found to work well and are much cheaper than iron, the principal trouble being in the joints, which are weak.

The river is crossed at Pearl street, for supply of the west side, by a 12-in. wrought-iron riveted pipe with wrought-iron spring flanges, in 17 lengths of 42 ft. each. It was laid in a trench by means of a coffer dam of sand bags. Before this was laid a temporary supply was carried over the bridge in a 6-in. Wyckoff pipe, laid in a box packed with sawdust.

In 1880 there were 22.26 miles of pipe in use, 235 fire hydrants, and 819 taps.

The population in 1870 was 16,507, and in 1880 was 32,015, and the daily consumption was 1,107,-427 gallons. Meters have been used from the first, and in 1880 there were 90 in use. The cost of the works to May 1, 1880, had been $404,296.01, and the expenses for maintenance to the same date $49,-441.46. The total receipts had been $60,771.78.

For the year 1879-80, the receipts were $15,157.49 and the expenses $9,417.11.

The works are managed by a Board of Public Works, Thomas Farmer, Jr., being the superintendent from 1878 to 1880.

Work of construction is done by the City Engineer. When the works were built, E. W. Muenscher, C. E., held this position. It has for some years been filled by A. C. Sekell, C. E.

XLI.—HOLYOKE.

Holyoke, Mass., is on the west bank of the Connecticut River at a point where the river falls 60 ft. in ¾ mile, affording a water power which was developed in 1849 for manufacturing. The town is regularly laid out on high ground. Originally part of Springfield, it was incorporated as West Springfield in 1786, as a separate town in 1850, and as a city in 1873, the population being about 14,000. In that year water-works were built by the city, after plans by J. Herbert Shedd, C. E.

The water is taken from two contiguous mountain ponds, Wright's and Ashley's, connected by an artificial canal. The larger pond has a flowage of 151.6 acres, and the smaller of 35.2 acres. Their available water shed is 2.7 sq. miles. The surface is hilly, composed of gravel and ledges of trap rock and slate. The ponds are fed largely by subterranean springs, and the water is of good quality.

There is a masonry gate-house at the head of Wright's Pond, from which water is admitted to the cast-iron main leading to the city, about 19,000 feet long, varying in diameter from 20 to 16 and 12 inches, according to the pressure to which it is subjected.

The distribution is by cast-iron pipes, 24 miles of which were in use in 1880, 7.7 miles being of 4-in. diameter.

The population is 21,851, and the consumption not given.

There are 141 public hydrants and 300 private hydrants in use, and 3,689 families are supplied from the works.

Meters have been used since 1874, and there are now 59 in use.

The cost to Dec. 31, 1880, had been $312,142.29.

The revenue from water for 1880 was $39,362.52, which was $10,500 in excess of the expenditures for the year for all purposes.

The works are controlled by a Board of Water Commissioners. E. C. Davis, C. E., is engineer, and M. Stevens superintendent.

XLII.—HUDSON.

Hudson, N. Y., is on the east bank of the Hudson River, 115 miles north of New York City. A slate rock bluff rises abruptly 60 ft. from the river, and from this the ground slopes up for 1½ miles to Prospect Hill, 500 ft. above the river. Settled in 1783, it was incorporated as a city in 1785. From an early date in the present century there was a supply of drinking water furnished to the city through an iron pipe leading from a spring two miles distant.

In 1874-5, the population being about 8,600, water-works were built by the city, after the plans and under the superintendence of J. B. G. Rand, C. E.

Water is taken from the Hudson River, pumped

to a filter bed, filtered into a storage reservoir and distributed thence.

The temporary inlet to the pumps begins in a solidly filled pier. From here an 18-in. cast-iron pipe, laid 8½ ft. below high water, runs to the 12-in. vertical suction pipes of the two engines. From the same point a box conduit of 2-in. plank, 3 ft. by 1 ft., extends to a point near the end of the steamboat pier, supported and protected by 4 lines of piles. A copper wire screw protects the other end, which is 35 ft. below the surface of the water.

There are two pairs of double-acting condensing crank and fly-wheel engines. The steam cylinders are 25 in. in diameter, with stroke of 36-in. They are situated on the second floor of the engine house, the pumps being directly under them.

The pumps are 8½-in. diameter, and of 36-in. stroke. The engines are capable of lifting 500,000 gallons per day 300 ft. high through the 12-in. rising main, which is 7,400 ft. long.

The filter and reservoir adjoining each other are erected on Prospect Hill. They are separated by a wall 14 ft. wide on top, and are in excavation and embankment.

The smaller or north basin receives the water from the pumps through a masonry inlet well, the wall of which rises even with the top of the filtering material, over which the water flows. The filtering material is arranged as follows, beginning at the top: 6 in. of fine white sand; 18 in. of coarser dark sand; 6 in. of ¼-in. gravel; 6 in. of ½-in. gravel; 6 in. of 1-in. broken stone; 6 in. of 2-in. broken stone; 24 in. of 4 to 8-in. stone fragments. Total, 78 in. The stone fragments rest on the concrete bottom of the basin, 6 in. thick, which slopes slightly toward the centre and outlet. A dry masonry stone culvert leads along this lowest line to an effluent chamber connected with the city supply main and with the storage basin, so that water can be drawn to the city direct from the filter. The sand is removed when dirty and washed in a "washer" and then replaced. It is shoveled off the top to the depth of 1 in. by flat shovels, and then washed, replaced and leveled. The filter basin is 13½ ft. deep, and with crest area of 15,081 sq. ft. and 9,081 ft.

The clear-water storage reservoir has an area of 32,696 sq. ft., is 20 ft. deep, and contains 3,200,000 gallons. The slopes are 1½ to 1 in. side, faced with dry rubble masonry 12 in. thick at crest, and 18 in. at bottom laid on 9 in. of 2 in. broken stone. Over a portion of the sides, in excavation, no puddling was necessary, the clay and gravel of a glacial moraine forming a perfect natural puddle. This was also used in constructing the puddle wall built in all embankment, from impervious strata to the crest, 8 ft. wide at the bottom. At the foot of the northern slope, near the inlet, is the outlet gate-house, from which an 18-in. main, branching into two 12-in. pipes, leads to the city.

The filter works satisfactorily, and the muddy water from the river, which is quite turbid, becomes clear to a depth of 15 and 20 ft.

The distribution is by cast-iron pipes. In 1879 there were 12.5 miles of pipe, of which 5 miles were of 4-in. diameter and ½ mile of 3-in. diameter.

The daily average consumption during 1879 was 938,187 gallons. The population in 1880 was 8,669.

There are 176 fire hydrants in use.

The number of taps is not given in the reports.

The cost of the works to 1879 was $256,000. The revenue from water the same year being $941, and cost of maintenance $7,645.12.

The works are managed by six Water Commissioners. John S. Ray has been superintendent since 1875.

CORRECTIONS.—Readers of this series of articles will please make the following corrections:

July 2, p. 265. *Richmond.* Omit *The superintendent's name is H. C. Richmond.*

July 9, p. 272. *Toronto.* First column, 36th line for *cable*, read *cobble*; 56th line, for *an under-box*, read, *a wooden box.*

Worcester, p. 272, 3d col. 4th line, and p. 273, 1st column, near end, for *Phineas*, read *Phinehas*; p. 272, 3d col. 30th line, for *breasting*, read *heart.*

P. 272, 3d col., 37th line, and 56th line, and p. 273, 3d line, for *spiling wall*, read *heart wall.*

July 16. *Troy*, p. 283, 14th line, for *tower*, read *town*; 41st line, omit *were.*

P. 285, 1st col., 7th line from bottom, for *Rump*, read *pump.*

Ottawa, p. 285, 3d col., 10th line, for *rich*, read *rock*; 26th line, for *frasel*, read *frasil.*

Lawrence, p. 285, 4th line from bottom, for *birch*, read *brick.*

Manchester, p. 287, 1st line, insert *longitude*; 2d col., 1st line, for *journal*, read *Jonval.*

(TO BE CONTINUED.)

We have received from Geo. A. Kimball, City Engineer of Somerville, Mass., the seventh annual report of the City Engineer, and also the third annual report of the Board of Health; from George H. Chandler, Engineer of the water-works of Kalamazoo, Mich., reports containing a history of the fire and water department from the years 1843 to 1881.

CORRESPONDENCE.

FORMULAS FOR TURNOUTS—CORRECTION.

KOKOMO, Colo., July 10, 1881.

EDITOR ENGINEERING NEWS:

In the article on "Formulas for Turnouts," in your issue of July 2, the last term of the denominator of the right hand number of equation (3) is $\times ba$; it should be $+ba$. Please announce this correction. S. E. REAUGH.

BRIDGE PINS.

178 DEVONSHIRE ST., BOSTON, July 16.

EDITOR ENGINEERING NEWS:

In J. A. L. Waddell's paper on "Bridge Pins," in your issue of July 9, he speaks of the need of an instrument to find "the actual moment, which is represented by the diagonal of a rectangle whose sides represent the vertical and horizontal moments." The "Graphic Trigonometer" does this readily and accurately, and in a similar way solves many other problems connected with the designing of bridges.

I shall publish a new descriptive circular soon, which I will send to anyone interested.

Yours truly,

EDWARD P. ADAMS.

VARIATION.

CAMP IN 4-MILE CAÑON, Boulder Co., Col., July 18, 1881.

EDITOR ENGINEERING NEWS:

I notice in the NEWS of June 18, page 249, a note by R. W. McFarland, copied from the *Ohio State Journal*, stating that the engineering class of the University found a difference of 40 and 41 minutes in the variation of the needle at the north and south ends of the "United States Meridian Line in the State House Yard." Is there not some local cause in the shape of gas or water pipes, lamp-posts, iron fence or something of the kind to which it can be attributed?

The line, with the *cause* of this *difference undetermined* is practically useless; as, *which* is the *true* variation is not known. If it cannot be found and removed, a new meridian should be established at a place *known* to be free from local attraction, as there would still be a liability to error even though the cause of the difference is known and not removed.

The disturbing cause may not have existed at the time of establishing the meridian.

Respectfully submitted,

E. A. D. PARKER.

CHAUDIERE BRIDGE.

TORONTO, July 18, 1881.

EDITOR ENGINEERING NEWS:

In your narrative, the description of the Chaudière Bridge Floor System is as follows: "In this bridge the vertical columns are slotted so as to allow the cross-girders to pass through them, the girders thus resting directly upon the casting which carries the column, and through which passes the steel pin receiving the different chords and braces."

In reply to Mr. Peterson I must admit that I have not seen the Chaudière Bridge, nor the adopted plans, but based my statement upon the above extract.

The Grand Trunk design is as follows: The keelsons, or cross-girders, are made of plates and angle irons. The lugs of the posts, they being Phœnix columns, are slotted so as to allow the web plates of the keelsons to pass through the posts. Then these plates, resting upon the tops of the foot-castings, are riveted to the lugs of the posts. No suspension-hooks are used.

Clarke, Reeves & Co., of Phœnixville, built the Stark and Nulhegan bridges, both situated on the Eastern Division of the Grand Trunk Railway, with floor-systems of this design, in the year 1877 or 1878. TOM D. HANNAFORD.

PROBLEM IN GEODESY.

SYRACUSE, N. Y., July 18, 1881.

EDITOR ENGINEERING NEWS:

SIR: Mr. L. L. Nichols' note in the current number of the NEWS calls up the discussion of the subject of locating a section of the parallel in the NEWS during the summer of 1879; and I find upon referring to my letter at page 242, Aug. 2 of that year, that a couple of typographical errors crept into the formula at the bottom of that page which escaped my attention, from the fact that I did not see the printed letter for two or three months after issue. The formula should stand

$$H - H' = K^2 \frac{\tan. H (1 + e^2 \cos.^2 H)}{2 N'' \sin 1''}$$

I have answered Mr. Houston's queries (in NEWS for June 11) by mail, direct, and I therefore will not reopen the discussion at the present time, except to say that the *simplest* method of locating the curve of a parallel is by running a tangent to the curve (right angle to the meridian), and measuring calculated offsets from it at all points desirable. An objection to Mr. Nichols' method, in practice, is that the continual measurement of deflection angles (however carefully done), increases the probability of error. In the other case the only angular measurement is that between the meridian and the base line, which has to be made in any case. Upon the northern boundary of the United States the right angle to the meridian was fixed at the mean of from 50 to 60 observations. There only remained accurate transit work, and careful, direct and offset measurement.

Very truly yours,

H. W. CLARKE, Member A. S. C. E.

Leighton Bridge & Iron Works, of Rochester, N. Y., has been leased for a term of years to John F. Alden and Moritz Lassig, who in future will conduct the business. Offices: Rochester, N. Y., and 705 and 707 South Clark street, Chicago, Ill.

MORRISTOWN, N. J., July 18.—A party of gentlemen prominent in the directorship and management of the Delaware, Lackawanna & Western Railroad Company on Saturday purchased the Sussex Railroad, extending from Waterloo, on the Delaware, Lackawanna & Western Railroad, to Franklin, Sussex County. It is understood that extensive alterations and improvements will be shortly begun and trains will be run in connection with those of the Delaware, Lackawanna & Western road

PRESENT CONDITION OF THE BUILDING TRADES.

We take the following extracts from the July number of *Carpentry and Building* in regard to the building industries throughout the whole country. In compiling the article, the masonry information was obtained by sending nearly 3,000 circulars to subscribers of that journal located at as many different post-offices. The response was very general, and embraced all the principal cities and towns, as well as many places of less importance. The three lines of trade considered are carpenters, masons and house painters:

"To give the result of the survey in the fewest possible words, we might say that the 'boom' extends all along the line. The building business is brisk. Mechanics in general are fully employed. Wages are fair, and in many directions there is an upward tendency. All the building that it is reasonable to expect can be completed before the bad weather of the fall and winter sets in has been undertaken in nearly every community. In short, there has never before been such a season of general prosperity in the building trades in the history of the country.

"Wages vary according to localities, being for the most part lowest where living is the cheapest, and highest where living costs the most. The ratio, however, is not maintained in all cases, and if close estimates were to be made we think it would be discovered that those who live and labor in communities where rents, provisions and supplies generally are cheap, have the advantage of their fellows in the larger cities, even though the wages of the latter are considerably higher. The average of nine principal cities situated in the East and on the Atlantic seaboard, considered together, shows that carpenters are receiving about $2.50, masons a trifle over $3, and painters about $2.50 per day. By this comparison it appears that Boston is paying the average prices of the cities named, while New York and Philadelphia are paying above the general average. A like calculation made for nine of the principal cities of the Western States gives a very similar result, the exact figures being: carpenters, $2.44; masons, $3.11, and painters, $2.33. Of these cities, Chicago and St. Louis are paying considerably above the average, the figures for the first-named being: carpenters, $3; masons, $3.50, and painters, $2.50, and for the latter, carpenters, $2.75; masons, $3.75, and painters, $2.50. Omaha reports carpenters, $2.75, masons, $3, and painters, $3. Going still further West, the general average shows an increase. When we get to some of the mining towns, the figures reported are apt to fill mechanics in the older parts of the country with envy. Four dollars per day for carpenters and masons is not an exceptional rate. The average of all the towns in Colorado from which we have replies indicates high prices generally. They are as follows: Carpenters, $3.25; masons, $4.25; painters, $3.25 per day. The few towns in New Mexico where building operations are being carried on pay wages even higher than the figures last named, and the same may be said of Arizona. We do not anticipate that this announcement, however, will cause a stampede of mechanics to the region named, for many of the inhabitants of these districts, in the simplicity of their hearts, consider a wigwam or an *adobe* hut entirely sufficient for all purposes. Our figures from Utah are lower than those last quoted, and the reports show a little more of the enterprise of civilization. Salt Lake City, in spite of Mormonism, is building actively, and carpenters command $3, masons $3.50, and painters $3 per day. The report from California is not as cheerful as from most of the States. A number of large blocks are going up in San Francisco, but building operations cannot be called brisk in the sense in which that term is employed in the East. Quotations of the labor market from that State may, therefore, be declared to be nominal, for in almost all cases less than the full number of mechanics are employed. Carpenters are receiving all the way from $2.25 to $4 per day; masons from $3 to $4.50, and painters in about the same proportions. The highest figures are paid in the mining towns. Far-off Oregon reports a fair activity in her towns and cities, with wages for carpenters at $3.50; masons, $4, and painters $3 per day.

Returning eastward and to the South, all the reports we have from Texas show that mechanics are generally employed in that State. The lowest quotations for carpenters is $2 per day, and the highest $3. Masons wages range from $2 to $4 per day. The average of the State by the reports received is as follows: carpenters, $2.82; masons, $2.82, and painters $2.50 per day. Galveston pays the highest prices in the State, the rate being: carpenters, $3; masons, $4; and painters $3.50 per day. From Louisiana the general report is that mechanics are fairly employed, and that building operations are moderately active. At Shreveport carpenters are getting $3.50, masons $4, and painters $3.50 per day. Along the Mississippi River prices are much lower. $2 for carpenters, $3 for masons, and $2 for painters being near the average. Only one town in Arkansas reports building operations dull, the prospect not encouraging and mechanics only partially employed. The wages reported seem to account for this condition of affairs. They are as follows: Carpenters $3, masons $5, and painters $2. The general average through the State is about $2.50 for carpenters, $2.75 to $3 for masons and $2.50 for painters. Our returns from Mississippi show about the same average as last quoted. From this State we have reports of both white and colored labor, the latter being about 25 per cent. lower than the former in places where both are given. In Alabama the general average also appears to be the same. Mobile reports building operations very slow, with wages nominally $2.25 for each of the trades quoted. There is no special activity reported in Florida. In Georgia there is more doing. Mechanics are quite generally employed, and the prospects for the immediate future are promising. Wages average lower than in States last named, and are about the same as a rule in North and South Carolina. They may be quoted as follows: Carpenters, $1.50 to $1.75; masons, $1.75 to $2; and painters, $1.50 to $2. Savannah reports carpenters, $1.75; masons, $2.50 and painters, $3, from which we infer the people of that town appreciate paint more than they do foundations and superstructure. Throughout Virginia the outlook is reported as promising. Wages are at neither extreme. In Richmond they are said to be, carpenters, $2.25; masons, $2.50, and painters, $3. At Hampton, where several important building are in progress, the rates are a little higher. Crossing the mountains we find about the same general conditions prevail in West Virginia. In Maryland mechanics are very generally employed, $2 for carpenters, $2.50 for masons, and $2 for painters, being about the general average. From Baltimore the report is, carpenters, $2.25; masons, $3.50 to $4; and painters, $2.25. Delaware is fairly active, with rates somewhat less than reported for Virginia.

"Coming back to our original starting point, the Eastern Atlantic States present unusual activity in building matters in almost all sections. The smaller towns vie with the larger cities in the variety and extent of their enterprises. Maine, New Hampshire and Vermont are perhaps less active than Massachusetts, Connecticut, Rhode Island and New York, although they are by no means dull. For Maine the general average of rates indicates that carpenters are receiving $1.75 to $2; masons, $2 to $2.75, and painters, $1.75 to $2.25, according to location. Rates are a little higher in New Hampshire, and about the same in Vermont. The average for Massachusetts is about $2.25 for carpenters, $2.75 for masons and $2.25 for painters. These are the exact figures reported for Providence, and are also about the general average for both Rhode Island and Connecticut. Reports from 96 different points in New York show that mechanics are very generally employed throughout the State at present, and are likely to remain so until bad weather sets in. In almost every town of any importance a church, a hotel, a factory, a school-house, or some other important building enterprise is reported. In the smaller places wages average about $2 for carpenters, $2.75 for masons and $2 for painters. In the larger cities rates are from 25 to 50 cents per day higher. It would require more space than we can devote to this entire article to give a detailed account of building operations in this city. It is estimated that the work now in progress represents an expenditure of upward of $35,000,000. The building activity of the present season is unprecedented. The business structures being erected are remarkable for height and amplitude of dimensions, and the dwellings are notable for the elaborateness of ornament employed and their costliness beyond the work of any other period. It seems to be settled that the down-town streets are to be lined with rows of buildings from eight to ten stories high. Ground room grows dearer every year, but sky room costs nothing. The suburbs of New York also present scenes of activity. Among them, Orange, N. J., a city which by the last census shows the most rapid growth of any in the country, is especially busy in adding new dwellings for New York's business men. Wages in this locality are reported as follows: Carpenters, $2.50; masons, $3; and painters, $2.50. New Jersey is generally active, wages, however, ranging somewhat below those just quoted.

"Turning our bird's-eye view again westward, we find Pennsylvania well up to the general average in building enterprises. Many of the smaller towns report fine dwellings, showing that some of the money which has been made in the past few years is now being expended. Taking the State as a whole, wages average about $2 for carpenters, $2.25 to $2.50 for masons and $2 for painters. Ohio, Indiana and Illinois are all very busy. Opera-houses, town-halls, school-houses, churches, court-houses, business blocks and costly dwellings seem to be the order of the day throughout the regions named. There is hardly a town of any importance but sends in an account of some such enterprise. Wages through Ohio seem to average about $2.25 for carpenters, $2.75 to $3 for masons and $2 to $2.25 for painters. The general average for Indiana is 12½ to 25 cents per day less. The smaller places throughout Illinois show about the same results, with higher figures in the cities. The figures in Tennessee and Kentucky are lower, averaging not over $2 for carpenters, $2.50 for masons and $2 for painters. Building operations are less active in these States than northward across the Ohio River.

"Missouri and Iowa are scenes of activity in building matters at the present time. What we have said about Ohio, Indiana and Illinois, applies as well to them. Wages in Missouri average $2.25 for carpenters, $3 for masons and $2.25 for painters. In Iowa the average is slightly above these figures, with rates considerably in excess at those points where operations are unusually extensive. The lower peninsula of Michigan is quite active, with wages averaging about as quoted for Ohio. Wisconsin does not seem to manifest equal enterprise, although building matters for the State at large cannot be declared dull. Wages average about $2 for carpenters, $2.50 for masons and $2 for painters. In Minnesota business is better and rates are higher, the average being something like $2.25 for carpenters, $3 for masons and $2.25 for painters.

THE INCHKEITH FORTIFICATIONS.

After an interval of 300 years, the island of Inchkeith, in the Firth of Forth, has again become a fortified place. The island, which is about five-sixths of a mile long, was taken possession of and fortified by the English, retaken by the French auxiliary forces in 1549, and finally dismantled in 1567. It belonged to the Keith family at one time, then reverted to the Crown, and, when taken over by the government, was the property of the Duke of Buccleuch. In again fortifying the island, great difficulties had to be contended with, principally owing to the steep nature of the ground—mules having to be used for draught purposes instead of horses—and from the danger attending the landing of men and material in any but the finest weather. To make the fortifications complete, the guns only require to be mounted. Six 18-ton guns are expected to arrive from Woolwich in a day or two—four for Inchkeith and two for the supporting fortifications at Kinghorn Ness. Rising as the island does to a height of 180 feet, the mounting of the guns, it will be seen will be a heavy task. About 60 Royal Artillerymen have been on the island for a week past, waiting the arrival of the guns. They are camped out in tents between the light-house and the northmost battery, the officers living in a marquee, while another marquee does service as the canteen. It was at first proposed to erect a barracks for the men who will act as a garrison on the island in time of war; but after the foundations had been excavated, the government decided not to go to this expense, and the trenches were filled up. When the guns have been mounted, only one sergeant and four men of the Coast Brigade Artillery will be left in charge, and their duties will be to keep the guns in order. These men have a small barrack in the center of the south battery, consisting of two rooms, one being occupied by the sergeant and his wife, and the other by the four artillerymen. Two small patches of ground have been cultivated, and a good yield of potatoes is expected. Lately a number of young seals have been seen swimming round the island, but the want of a boat has prevented the men catching any of them. There are several fresh-water springs, the water used by the encampment being pumped up from the northwest side of the island.

The fortifications, as now completed, consist of three batteries—namely, the north, northeast, and south. The forts have been built on the polygonal

system, with modifications generally adopted in this country, the features of the bastioned system being combined. One new feature is that the guns will be fired over the parapet, and not through embrasures or loopholes, this being effected through their being placed on a raised, turret-shaped concrete platform on the Moncrieff principle, and run on swivels. The parapet is also made of concrete, sloping downward on the outside, to allow the guns to be pointed to a near range. Recesses are placed on the inside of the wall in which the men can be protected, the platform round the wall being lower than the terreplein upon which the guns are placed. The south battery will have two guns, and has a draw-bridge at the entrance across the ditch. Entering the north battery through a passage arched over with brick, a stair leads down to the casemate magazine, which is bomb-proof. No lights are allowed to be taken into this arched chamber, the floor of which is laid with wood, but light is supplied through a passage made for the purpose, with small windows in which lights are placed to allow the men to see to move about in the magazine. The passage has no entrance into the magazine itself. There is a lift and a speaking-tube from the casemate to the landing above. Entrance is also gained from this landing to a casemated vault, provided for the defense of the ditches, with small loopholes for musketry-firing in such a position as to sweep to right and left. The wall of the ditch is the only portion of the works that can be seen from the sea. All the forts are built on the same principle, though slightly differing in detail.—*Scotsman.*

LONDON UNDERGROUND RAILWAYS.

The London Underground Railway differs from all other English railways in this—that it has neither beginning nor end. Other lines are alternations of cuttings and runs in the open, more or less elevated above the natural level of the surface, occasionally varied by a tunnel; this is a continuous burrow, a succession of covered ways, with troughs of various lengths at irregular intervals, open to the sky for light, but more especially for ventilation. On other railways you measure space by miles; here you count it by chains and furlongs. Other lines run a dozen, perhaps 20 or 30 trains daily; the number of trains passing over the Underground every day is little short of 2,000. The most thriving of other lines do not count up more than £100 sterling a mile in their receipts; the Underground yields over £1,200 sterling a mile. Last year (1880) 150,000,000 of people passed over this line, and on Whitsunday, 1880—the day when the greatest number went over it—the number of passengers traveling to and from different stations was 689,497. These facts at once prove the inestimable value and importance to Londoners of the Underground Railway, and show what a blessing it is to the vast population which must get quickly to its work, and to which the breath of country air, now within reach of the poorest, is life and health.

The first portion of the Metropolitan Underground Railroad, extending from Bishop's road to Farringdon street, was opened for public traffic on the 10th of January, 1863. It was then in the nature of an experiment. So prompt and grand was its success, that the work was continued, until now its ramifications extend, in a thickly-webbed network, from almost every central and suburban point where people live, to every central and frequented point where people work.

Extensions were rapidly made westward toward Hammersmith and eastward into the city, having termini at Moorgate and Broad streets, while a branch line, joining the first at Baker street, extended northward to the secluded quarter of St. John's Wood. While one circle will carry you from Moorgate street via Euston road, Tottenham Court road and Edgeware road to Notting Hill and Kensington, an outer circle conveys you by King's Cross to the Northern chain of suburbs, notably to Kentish and Camden towns. As the enterprise has become more and more extended, new improvements have been added, the tendency in England, as well as in America, being to increase the conveniences and luxuries of the traveler. More recently, open have been preferred to covered ways or tunnels, and every opportunity has been taken to increase the number of the former, so that the latter ramifications are only to a certain extent underground. When the property which had to be purchased has been moderate in price, the line of the road has simply been made a valley instead of a burrow. But when, as occurred in one instance, the company have had to purchase rows of costly mansions, half built, this plan is too expensive. In many cases the tunnels have been run underneath large buildings, which have been underpinned, the business in which was not for a moment interrupted. For three miles of railway more than 50,000 cubic yards of earth was removed, and of the clay which partly composed it 22,000,000 bricks were made. The new stations are admirable structures in the adaptation to their purpose. The double station at Kensington High street is, perhaps, the largest and best of them, and may be briefly described:

The center consists of a spacious and lofty apartment, 44 by 35 feet, which is used as a refreshment room. The two ticket offices—for this station is double, as being at a junction between two lines belonging to different companies—are across the ends of the building. These, as well as the station walls and roofs, are very light, graceful and effective structures. They are faced with white perforated bricks; the doors and windows have semi-circular heads, and each window sash is filled with a single sheet of plate glass. The entrances to the ticket offices are under iron verandas roofed with glass. These offices are, of course, on a level with the street, and the station is surmounted with an ornate cupola. Galleries cross the rails overhead for exit, entrance or change of platform. Stairways descend underground from the offices to the platforms on either side, this subterranean apartment being lighted partly by skylights above and partly by globular lamps suspended over the platforms on either side. The station is abundantly supplied with closets, neatly fitted up for the convenience of passengers. The platforms are plank floors, and are sufficiently long to secure six English cars 42 feet long each, with engine and tender. Opposite the platforms, on the walls, are large signs with the name of the station, besides numerous advertisements of every imaginable commodity, in letters of every shape, size and color, some of them being really handsome pieces of ornamentation. The arrangements are so perfect that there is room enough for all, and although the train stops seemingly an instant in each station, it does not start until every passenger is, as the case may be, in or out.

As in most other English railways, the cars of the Underground are divided into first, second and third class, with accommodations and comforts corresponding and fares graduating accordingly. It is not, therefore, surprising to learn that the number of third-class passengers has always been greatly in excess of those of the two other classes combined. The best patrons of the Underground are the artisans, the people who live by the toil of their hands and the sweat of their brow; and it is to this great class that the Underground has itself been a boon of value to them incalculable. The percentage of first, second and third-class passengers passing over the road is relatively as follows: First class, 10.94; second class, 20.29; third class, 68.77. These figures of themselves show that the Underground is essentially and emphatically a people's line. They are carried to and from their business in well-built, airy cars, which, if not cushioned and carpeted like the first-class cars, have, at least, clean wooden seats, wide windows and plenty of room. The average third-class fare for any distance is twopence (4 cents) each, being two-thirds less than the omnibus and tram-car fares, the speed of transit being thrice as rapid; but there are, besides, morning and evening hours, during which penny (2 cents) trains are run for the benefit of the workingman. Every such train is known as the workingmen's train. The workmen may travel by trains running at intervals of five or ten minutes from 5 in the morning until 12.30 at night. Their fare is saved in shoe leather alone; for the laborer who now for his penny goes from his suburban cottage to his factory in the heart of the city, six or eight miles, by steam, was wont formerly to trudge it wearily, to the wear and tear of his constitution, as well as of his boots.

It may be interesting to know how this great line is managed, and what measures have to be taken to insure the public safety and comfort. Probably there is no man in London—not excepting even the Lord Mayor himself—with heavier responsibilities resting upon his shoulders than the manager of the Underground Railway. An outsider might think that the working of the line is easy enough—that it is only setting trains in motion and keeping them running to time. The general manager is commander-in-chief of the line, and pays for the power and dignity by bearing the responsibility for everything which goes wrong, and by receiving but scant acknowledgment for the great deal that goes right, and for the inevitable anxiety and eternal vigilance which are indispensable in the performance of his office.

If, at 4:30 a. m., we are "early birds" enough to be up and find ourselves at the big shed of the Edgeware Road Station, we shall not have to wait long before seeing the engines turned out, which initiatory operation takes place 20 minutes before 5. The night before they have been thoroughly examined, oiled, cleaned and prepared for the ensuing day's work. They start off in rapid succession to the different termini of the line, where there empty trains are sheltered during the night. At 10 minutes after 5 the trains begin running according to the time tables. The engines arrive at the stations in succession, leaving again with the trains attached 10 minutes afterward. For example—an engine arriving at 5 a. m. leaves with a workmen's train at 5:10, and so on. At first there is plenty of room in the trains, the travelers in the very early morning being scant groups of sleepy folks huddled napping in this corner and that. As the morning advances the traffic increases, and now the trains are run in quick succession, the average intervals between them throughout the day being three minutes. At 7:27 p. m. the withdrawal of the locomotives begins, and continues until 1:15 a. m., when the last locomotive puffs into the Edgeware Road shed, which is the resting place of all the engines for the night. The last train is the Hammersmith train, which steams into Moorgate street at 12.40; the average number of passengers for the 20 hours having been upward of 350,000 on the Metropolitan alone. Besides this traffic of the Metropolitan proper, the Great Western, Midland, Great Northern, and London, Chatham & Dover companies send more than 400 trains over the same rails every day. Of late the Metropolitan or principal underground company, has become a sort of key by which the traffic of nearly all the railways branching out or London is interchanged. You may procure tickets from its stations to almost every point in the three kingdoms, and make connections accordingly from almost every point in the three kingdoms, from almost every part of the metropolis to your destination in the country.

Extensions of the two lines, known generally as the Underground Railway, are constantly in progress of construction. At one end the railway has been extended from Moorgate street, in the city, to Liverpool street, in the far east end of London, thus forming connection with the whole great eastern system of railways. Then a section was completed, some time ago, between Westminster and Cannon street, along the Thames, which has proved a boon to the thousands who used to crowd the little penny steamboats on their way to the city from the regions of Chelsea, Pimlico and Brompton. One of the greatest blessings of the underground railway to the cockney world has been to thin out, in some degree, such choked up, dangerously crowded thoroughfares as Piccadilly, the Strand, Fleet street and Cheapside. Since the opening of the Thames Side Railway, between Westminster and Cannon streets, the number of cabs and omnibuses which used to suffocate those great arteries of traffic has largely decreased; and already, it is estimated, this "inner circle" of the Underground has thinned out 150,000 from the vast throng which crowds the central thoroughfare of the metropolis.

Statistics prove, too, that traveling by the Underground is less perilous to human life than riding or even walking in the streets. During last year nearly 400 persons were knocked down and killed, by vans and other vehicles, in London streets, besides the many hundreds that were injured, but more or less narrowly escaped death. But of the 150,000,000 who traveled by the Underground, only a very few lives were lost, and not a solitary one by any neglect or fault of the company's management.

The entire length, or more correctly, circle, of the Underground Railway, and all the branches, are fitted with the block system, and the machine by which the trains are worked is so ingeniously designed that it is almost beyond the range of possibility that a train should be run into the wrong station, or that there should be a collision. Nothing short of extreme negligence or criminal design could effect either of these calamities, for the instrument acts absolutely as a check upon any negligence on the part of the signalman. The management exercises the greatest care in the selection of subordinates, and the rules by which the latter are controlled are despotically strict. No one is taken into the service without a character, that is, a certificate of good behavior and habits from his previous employer; and, having entered the service, the employé is placed under very strict discipline—immediate dismissal being the peremptory penalty

for carelessness. On the other hand, the employés are encouraged to do well by a system of reward, for a yearly bonus is given to those who faithfully and zealously perform their task.

With its countless omnibuses and cabs, tramcars and little Thames steamboats, and its Underground Railway now ramifying in every part of the metropolis where traffic is to be relieved and the streets made passable, it would seem that London is well supplied with conveniences for locomotion. But this age, whether in England or this country, is never content with its new facilities. The later tendency in England is to give the government as large control as possible over institutions which are for the general benefit, and it may be that before long there will not only be a government horse railway, at least on the Surrey side of the Thames, but that the Underground will itself be brought in and governed by the ministers of the crown. However, there is no predicting what innovations John Bull will assent to until his assent is fully given.

"BEATING THE BOUNDS."

In these days of maps and surveyors a dispute about boundary lines is, or should be, quickly and easily settled. Reference is made to the maps and descriptions on file in the county offices; a surveyor and assistants armed with theodolite, chain and poles set out for the disputed territory; and after discovering the initial point run lines of the properly recorded length and direction to the stakes or stones as described, or to the points where the stakes or stones ought to be; and the question is determined without further fuss.

That was not the way things were done in the "good old days" in "merrie England," whatever may be the general practice now. Judging from some peculiar cases before English police courts last month the old methods have not wholly fallen into disuse. In two parishes, that of Brentford, made famous in the Duke of Buckingham's "Rehearsal" by its "two kings" who "enter hand in hand, smelling at one nosegay," and that of Hanwell, appropriately famous for its lunatic asylum, the old custom of "beating the bounds" to furnish witnesses for possible law suits growing out of boundary disputes is still kept up, and judging by the result of this year's whacking perambulation, with more zeal than discretion. It cost one of the Brentford "bounds beaters" a month's imprisonment because on last Ascension Day he tumbled an unsuspecting citizen into the river to impress upon his mind the fact of the parish boundary crossing the stream at that point. The Hanwell "beaters" were even more daring. The senior curate of the parish was encountered by the jolly "beaters" in the course of their rounds, and a sudden doubt seized them that the reverend gentleman might not be exactly sure of the territorial limits of his parochial authority. In a trice the grave and dignified clergyman was seized by arms and legs, and his body bent into the shape best fitting it for use as a battering ram. With a lusty swing he was "bumped" against a bystander, who was "knocked endways" by the unexpected blow, and thus two parish witnesses were simultaneously secured, an important boundary fact being rammed into each of them at that point of his anatomy where old-fashioned pedagogues were accustomed to drive the Latin tenses and respect for authority into the pupils as the most direct route to the brain. To the astonishment and indignation of the "beaters" the clergyman objected to the process and had the operators arrested for assault and battery. In fining them five pounds each the magistrate pointed out the error of the "beaters." Had they bruised their revered pastor's sitting provision against a "stake or stone" legally established as a boundary mark, they might, perhaps, have pleaded justification by ancient custom, but they had bumped him ignominiously against "a movable person," which was against all precedent and therefore without excuse.

The mistake of the Brentford boundary markers had been paralleled several years ago in the parish of Walthamstow, on the river Lea. A disciple of the worthy Izaak Walton was sitting in a secluded spot upon the river bank on a Holy Thursday afternoon, gently whipping the water with his fly and meditating on the beauties of a trout in his basket and the attractions of a buxom dame at the roadside inn where he intended taking his fish supper. A confused clamor of voices broke in on his solitude, and through a gap in the hedge behind him came an extraordinary procession. Foremost was the beadle, imposing in the dignity of gold-laced cocked hat and shouldered mace. A portly church warden with tall white hat and rosette in his button hole was closely followed by a restless throng of men and boys, some with ribbons in their button holes and others with peeled willow-wands in their hands. A whispered consultation between the beadle and his principal supporters was followed by a stern inquiry from the church warden if the angler knew that he had been sitting on the exact spot where the lines of the ancient parish of Walthamstow entered the Lea? Piscator answered humbly that if he had committed such a sacrilegious act it was done in utter ignorance. The words were no sooner uttered than he was caught up by four powerful arms and flung headforemost into the river, with the admonition to "remember well the boundary line of Walthamstow parish." The drenched angler succeeded in convincing the neighboring magistrate that as he was not a dweller in Walthamstow parish the parishioners had no warrant for making a parish record of him in this summary manner, and his assailants were fined fifty pounds and costs.

The irreverent excess of the Hanwell "bounds beaters" had a counterpart in the London parish of Paddington four years ago. The procession was passing gravely along the Edgeware road, cocked-hatted beadle, rosetted churchwardens, and willow-wanded parochial schoolboys in due order, when the boundary stone was reached where a boy should have been whipped to insure his future remembrance of the place. Suddenly the programme was reversed. The boys by simultaneous movement seized the beadle, and in spite of his commands, threats and beseechings they "bumped" him against the stone with such vehemence and rapidity of succession that at the customary social gathering in the back parlor of the "Pig and Whistle" that evening he declined to "take the chair," and remarked as he responded feelingly to the toasting of his "good 'elth," that it would be "sort of restin to lean against the chimbley piece during the festivities."

Whatever may have been the origin of "beating the bounds" of the parish, the procession whose progress was marked at intervals by such uncomfortable proceedings had at one time a strong religious character. Centuries ago, on Ascension Day, or on one of the other days of "Rogation Week," the parish officers, headed by priests and cross-bearers, and followed by the boys of the parish duly marshaled, made the rounds chanting hymns, and stopping at times for priestly benedictions upon farms and people. After the Reformation the procession continued with the service slightly changed, certain appointed portions of the gospels being read over the standing corn, litanies recited in which curses were invoked on him who "translateth the bounds and doles of his neighbors," and addresses made by the pastor to the company following him. Later on, the marking of special boundary points by religious services was changed for the more effective memorizing method of whaling the small boys, pitching them into the streams, knocking their heads together, bumping them against posts, trees, and barn corners, and then compensating them for their sufferings by occasional "snacks" of bread and cheese, a good supper at the end of the "perambulation," and a few pence of pocket money.

The writer has a lively recollection of the method of "beating the bounds" in a West of England parish "a long time ago." He and some other small boys were interrupted in a game of marbles by the approach of the "bounds beaters," a squad of whom made a dash upon the marble players with intent to flog into their memories the fact that the great oak near which they were indulging in "ring taw" was on the parish boundary line. There was a hurried scamper across fields and over hedges, and all but one luckless urchin escaped. Two or three years later the "bounds beaters" were followed part of their way at a safe distance, and great delight was taken in the scuffle at a farm house on the route where the "beaters" insisted on passing in at the kitchen door and squeezing through a low dairy window—upsetting a pan of cream in the passage—because the house unfortunately stood in two parishes.

Like many ancient practices that had at one time something of a religious character the custom of "perambulating the bounds" has been ascribed to a Pagan origin, and is alleged to have descended from the Terminalia, or observances in honor of the god Terminus, the Roman topographical deity. It is a curious fact, mentioned in Wallace's "Russia," that the Cossacks have a somewhat similar method of preserving evidence as to boundary lines. When a boundary dispute occurs a meeting is called and a hearing had on the spot. As soon as the line has been fixed, a number of boys are placed upon it and severely punished to impress the circumstances of the settlement and the location of the boundary line strongly on their memories. This is a curious coincidence, if nothing else.—*Cleveland Herald.*

COOLING MACHINES AT THE WHITE HOUSE.

WASHINGTON, July 10.—Experiments in artificial refrigeration are being made at the Executive Mansion to-night upon the most extensive scale. The unsuccessful attempts of the past three or four days have not only stimulated invention and mechanical ingenuity to the highest degree, but have caused a steady increase in the extent and magnitude of the refrigerating operations. Two different systems are now at work, one in the basement near the main entrance, and one at the eastern end of the mansion. The first, which is under the superintendence of Mr. Jennings, of Baltimore, and Mayor Powell, of the United States Geological Survey, cools the air by direct contact with ice; and the second, which is under the direction of Mr. Dorsey, produces refrigeration by the alternate compression and liberation of air. The apparatus used in the first system consists, first, of an immense ice-box about 30 ft. in length by 20 in width, holding 12 tons of ice, which is placed in large blocks on racks and open shelves, so as to permit a free circulation of air over and about it: second, of a refrigerating chest where the air is sifted between chilled plates having an area of 2,800 square ft. and covered with thin felting, which is kept constantly wet with ice-water; and, third, of a steam blower. The air is taken from the outside of the mansion at the western end, and carried first through the ice-box, where its temperature is lowered 20° or 30°, and then into the refrigerating chest, where it is still further cooled to a temperature of about 40° It is then forced up by the steam blower into the President's room. The capacity of this apparatus is said to be about 40,000 cubic feet of cooled air per hour, and it will change the whole volume of the air in the President's chamber every 12 minutes. The machinery did not get into effective operation until late this evening, but before it had been at work half an hour Dr. Bliss came down into the basement and requested that the blower be stopped for awhile, as the night was not a very hot one, and the President's room was already quite cool enough. It has been suggested that the cooled air supplied by this machinery may prove too damp for health and comfort on account of it's having been chilled by direct contact with naked ice. Should this prove to be the case, the air to-morrow will be dried by passing it over frequently renewed pans of chloride of calcium. The refrigerating system, which is an experimental operation at the east end of the mansion under direction of Mr. Dorsey, is the compressed air system used in cooling Western mines. A large stationary engine, which is supplied with steam by three of the city fire-engines, is at work compressing air. This air, when crowded into smaller space, gives out a great amount of heat, which is carried away by running water. As soon as the air is again set free it becomes refrigerated by expansion just in proportion as it has previously been heated by compression. The machinery used in this system here has been for the most part hurriedly improvised, and it is impossible to say whether it will work successfully or not. Among the most noticeable of the smaller and less elaborate refrigerating machines which have been set up here to-day is the cold-blast apparatus of A. J. Case, of Boston. This apparatus provides for a flow of air through a large ice-box, where, by contact with the ice, it becomes cold, condensed and heavy with this greater specific gravity. It then flows down an inclined plane to the bottom of the room, displacing the warmed atmosphere. The external air rushes into the ice-box constantly to take the place of that flowing out, and a constant circulation is thus maintained. In a small room this machine is very successful. It is probable, however, that one or the other of the two systems first described will be permanently adopted to-morrow.

FLORIDA LANDS AND LAKES.

Philadelphia and New York capitalists have undertaken the great work of reclaiming the swamp overflowed lands of Southern Florida. A company has been formed with Ex-Mayor William Stokely, of Philadelphia, at its head, which proposes to tap Lake Okeechobee with two canals, one to carry the water to the Atlantic Ocean, the other to the Gulf of Mexico. This Lake Okeechobee, it is claimed, is

nothing more than an immense sink-hole; that is, it has no visible outlet, and but one feeder of any importance, the river Kissimee, which pours into the lake 207,360,000 cubic feet of water every twenty-four hours. The lake has an area of 1,000 square miles. It is stated that during the summer, or dry months, evaporation so reduces the water in Lake Okeechobee as to bring forth dry land on the shores to the extent of several thousand acres. Then, when the rainy season comes on, the waters rise and these lands are again covered. With these canals and the aid of evaporation, it is proposed to draw off enough water to permanently rescue from the lake eight million acres of dry land.

The State of Florida will concede to the company doing this work one-half of the land thus reclaimed, which, it is said, will be most valuable for raising tropical products, and will embrace every class of Florida land.

The theory presented by this land company on its face seems as plausible as the scheme is stupendous. As an undertaking it takes rank with the proposition of a directly contrary work, to convert the Desert of Sahara into a garden by the introduction of the waters of the Mediterranean. It may be possible to draw the water from the lakes of Florida and make land as proposed, but many persons, who have studied the subject well, believe that the plan is not at all practicable. Florida is in many respects a peculiar State, and one of its peculiararities is the formation of its lakes. It is known that many of these bodies of water have neither inlet nor outlet; that is, they are simply standing pools, and that a few are to be found some distance inland whose waters are salty. Another peculiarity of Florida is found in the fact that large tracts of land have been known to suddenly sink from sight, leaving a lake or pond of water where they had stood.

A theory bold, but backed by fair argument, has been presented to explain the mysteries and account for the constant supply of water in these riverless lakes. This theory is to the effect that the peninsular portion of Florida is but a crust of earth floating on the ocean, anchored here and there by islands of rock that come up through the waters, or coral formations such as make the coral reefs abounding in the neighboring waters; and that beneath this floating shell of land the sea flows and has its currents just as it has them off the coast. By this theory it is claimed that there is practically no bottom to some of the lakes of Southern Florida and Okeechobee, which maintains an area of 1,000 square miles with but one feeder, is believed to be one or those bottomless lakes, gaining its main supply of water from the ocean, by subterranean passages. If this theory proves true the Florida Land Reclaiming Company will find the job before it rather huge, and will accomplish it only when they can lower the water in the ocean with a pump. —*Cleveland Herald.*

THE TEHUANTEPEC RAILROAD.

Wm. J. McAlpine, consulting engineer of the Tehuantepec Inter-Ocean Railroad, has just returned to New York after four months' absence on the route, and speaks of this really grand enterprise, of which the public know comparatively little, as in full progress toward successful completion. Between 4,000 and 5,000 men are at work, of whom 3,000 are on the northern end, where there are now 15 miles of finished road. As much more will be in operation in a few weeks. At the southern or Pacific end work was commenced in the middle of April last.

We were favored by Mr. McAlpine with full information. He was asked how the prospects of the Tehuantepec route compare with the proposed Lesseps canal or Eads' great ship canal, which secure so much more of public attention. Said he: "Two years from now we shall have the route through and in operation from ocean to ocean. Lesseps', it is said, will be finished in 10 to 20 years, and Eads' canal will be nearly or quite as long in building. Each of those works will cost not less than $500,000,000, the annual interest of which would pay a dividend of 300 to 400 per cent. on the investment in the Tehuantepec Railway, viz., $6,000,000. Hence," said Mr. McAlpine, "competition between these works is out of the question." He added that if the traffic contemplated by the projectors of the Eads scheme is realized as to volume, two tracks on the Tehuantepec road would do the whole of it, and such two-track railroad would cost less than $10,000,000, against the $500,000,000 required for either of the other projects.

For those who are not familiar with that part of Mexico bordering on the Gulf, it may be observed that the Tehuantepec road (for which Mr. Edward Larned, of Pittsfield, Mass., obtained a full concession) will run very nearly north and south, the northern terminus being at the mouth of the Coatzocoalcos River, which is almost due south from New Orleans. Its length will be 160 miles, and the saving in distance between New York and San Francisco, compared with the Panama route, will be 1,152 miles each way, or compared with the voyage around Cape Horn, 21,534 miles on the round trip. According to Mr. McAlpine, who has carefully surveyed the entire line, there are no unusual difficulties in building the road, as the grade nowhere exceeds 60 feet to the mile, and more than one-half of it is of the cheapest construction, nearly following the surface of the earth. The most expensive portion of it, and that extending a short distance only, will not exceed $60,000 per mile, making an average for the whole of not more than $25,000 or $30,000 per mile.

So quietly has the work proceeded that many will be surprised to learn that no less than 33 cargoes of material have been shipped to the Coatzocoalcos River up to the present date, most of them from New York, though the rails go from England and about 50,000 ties from Florida. Most of the ties, however, are found on the spot, comprising mahogany, rosewood and grisima, the two latter having a close resemblance. Lately, the chartered steamer Vidette left this port, taking out a number of engineers, a locomotive steam excavator and steam saw mill, besides large quantities of shovels, picks, barrows, corrugated iron for roofing, and other material.

A reason for special satisfaction is found in the selection of Salina Cruz as the harbor at the Pacific terminus, and which will serve as the base of operations on that coast; but the design is eventually to occupy Chipequa, where at no distant day will be one of the finest harbors on the Pacific coast. Altogether, the accounts brought by Mr. McAlpine are of a very cheering nature. The resident chief engineer is Mr. Van Brocklin, formerly engineer of the New York Elevated Railroad.—*Iron Age.*

SUNSTROKE—VALUABLE ADVICE FOR ITS PREVENTION AND TREATMENT.

In 1880 there were 116 deaths recorded from sunstroke in New York, while in 1789 there were only 41 deaths. In 1870 the record reached 298 fatalities resulting from sunstrokes, but that year was an uncommonly hot one. Up to July 9, this year, but 12 deaths from sunstroke have been reported. The majority of the persons who died were laboring people, those who worked along the river front and were stricken down in the performance of their duties. The New York Board of Health makes the following recommendation to prevent sunstroke: If working in the sun wear a light hat (not black, as it absorbs heat), straw, etc., and put inside of it on the head a wet cloth or a large green leaf. Frequently lift the hat from the head and see that the cloth is wet. Do not check perspiration, but drink what water you need to keep it up, as perspiration prevents the body from being over-heated. Have, whenever possible, an additional shade, as a thin umbrella, when walking; a canvas or board cover when working in the sun. When much fatigued, do not go to work, especially after 11 o'clock in the morning, on very hot days, if the work is in the sun. If a feeling of fatigue, dizziness, headache or exhaustion occurs, cease work immediately, lie in a shady and cool place. Apply cold cloth to, and pour cold water over head and neck. If any one is overcome by the heat send immediately for the nearest good physician. While waiting for the physician give the person cool drinks of water, or cold black tea, or cold coffee, if able to swallow. If the skin is hot and dry, sponge with or pour cold water over the body and limbs, and apply to the head pounded ice wrapped in a towel or other cloth. If there is no ice at hand, keep a cold cloth on the head and pour cold water on it as well as on the body. If the person is pale, very faint and pulse feeble, let him inhale ammoniac for a few seconds, or give him a teaspoonful of aromatic spirits of ammoniac in two teaspoonfulls of water, with a little sugar.

FORT WORTH, July 18.—The end of the track on the Rio Grande Division of the Texas & Pacific Railway on Saturday night was 341 miles west of this point. The end of the track on the southern extension of the Missouri, Kansas & Texas is to-day twenty-five miles south of this point. Work is progressing rapidly, with favorable weather.

MISSOURI IRON—CONSOLIDATION OF MOST OF THE INTERESTS OF THE STATE.

ST. LOUIS, Mo., July 18.—Some three weeks ago it was stated in the dispatches that a project was on foot to consolidate the iron interests of St. Louis and Southeast Missouri. It is now stated that this has been accomplished and that the Iron Mountain Company with capital of $3,000,000, Pilot Knob Iron Company, capital $1,500,000, Grand Tower Manufacturing Company, $1,000,000, Vulcan Steel Works, capital $1,000,000, Chouteau, Harrison & Co., capital $600,000, and the Jupiter Company, capital $400,000, have been brought into one combination and will hereafter be known as the Missouri Iron Company, with a capital of $10,000,000. It is stated that Charles P. Chouteau or Edwin Harrison, of this city, both of whom are very largely interested in the Iron Mountain Company and Vulcan Steel Works, will be president of the new company. The Pilot Knob and Grand Tower Works are owned principally in New York, but the other interests are chiefly in the hands of St. Louisians. It is said this consolidation will control about 90 per cent. of the iron product of Missouri.

NOTES.

LAND SLIP.

A great land slip near Sigrisweil, Switzerland, was reported on the 29th ult. It is steadily moving toward Lake Thun at a rate of three meters a day. It is three miles long, a mile broad, and the depth is unknown. Houses in its path have been deserted. Sigrisweil and neighboring villages are out of danger.

CHEAP HOUSE LIGHTING.

Sir William Armstrong, at Craigside, near Newcastle, England, has utilized a brook to run a dynamo-electric machine by means of a turbine water wheel, and so manages to secure electricity enough to keep thirty-seven Swan lamps in a state of incandescence in his house. In this case the motive power costs nothing, and electric lighting in this way is an exceptional luxury.

SLAG FOR BALLAST.

Blast-furnace slag or cinder is turned to a useful purpose at the Sclessin Iron Works, near Liege, Belgium. After the molten slag has escaped from the furnace it is conveyed immediately to a stream of cold water. The effect of this is a division of the slag into a substance very like coarse sand. This substance is then raised by an elevator and deposited in wagons, which convey it away to places where it will be applied as an excellent "ballasting" for railroads.

THE VALUE OF THE TELEGRAPH.

The value and efficiency of the telegraph as a social force able to concentrate instantaneously on any given subject all the best feeling and soundest opinion in the country were never more strikingly illustrated than in the case of the dreadful news which on Saturday, the 2d, was sent over the wires throughout the length and breadth of this colossal republic. It is difficult to conceive the extent of the damage which might have been done to all the interests of the country, political, financial and industrial, had such an event as the assassination of the President happened in a time of profound peace before the invention of the telegraph. Time would have been granted for the concoction and propagation of all manner of mischievous stories as to the origin, the motives and the consequences of the deed. Thanks to the telegraph, the news that the assassin had probably failed in his object reached the furthest confines of the republic almost as rapidly as the tidings of the nefarious attempt. The sound business judgment and patriotic feeling of good citizens in one part of the country were put into instantaneous communication with the sound business judgment and patriotic feeling of good citizens in all other parts of the country. An accurate return of the telegraphic messages, public and private, through which this work was done, between the morning of Saturday, the 2d, and the evening of Monday, the 4th of July, would give a most interesting statistical measure of the influence of the telegraph on modern society. Nor must it be forgotten that all this tremendous machinery was suddenly set in motion, and incessantly kept going, on the eve of the great national holiday, extending this year, as it did, over two of the three days thus occupied. This could not have been accomplished without extraordinary and unselfish efforts on the part of the great army of telegraph operators, high and low, all over the country. While the great army of spoilsmen who feed on the public crib were running to and fro, and cackling as to the possible

effect of the assassin's shot upon themselves, these silent and indefatigable workers were keeping up the swift and healthy circulation of public sentiment and public intelligence to meet the shock of an unexampled national crisis. It is gratifying to know that this admirable conduct of the whole telegraphic corps has not passed unrecognized by the heads of the organization. On Tuesday morning, when the first tremendous strain of the work began to be relieved, the following telegram was issued by the central office:

NEW YORK, July 5.

To all Superintendents:

The prompt and satisfactory manner in which our employés have met the emergencies of the service during the past few days deserves more than a passing recognition. Disregarding Sunday and holiday hours, they have remained on duty day and night, enabling us to keep the public all over the country constantly advised of the condition of the President. You are authorised to see that they are properly remunerated for the extraordinary service they have so willingly rendered, and to express to them the thanks of the company.

THOS. T. ECKERT, General Manager.

—*N. Y. World.*

ASTRONOMICAL.

"TWINKLE, twinkle, little star," the nursery rhyme so familiar to everybody, has been revised by a committee of eminent scholars, with the following result:

Shine with irregular, intermitted light,* sparkle at intervals, diminutive, luminous, heavenly body.†
How I conjecture, with surprise, not unmixed with uncertainty,§ what you are,
Located, apparently, at such a remote distance¶ from and at a height so vastly superior to this earth, the planet we inhabit.
Similar in general appearance and refractory powers to the precious primitive octahedron crystal of pure carbon,** set in the aerial region surrounding the earth.

* Or, Swad out with the antro-giespians.
† See Hesio. Pro mea benevolente. Act. Mediav. Pp. 992. Quisque numjam satis, vol. II., chap. 78, ¶XIV. Also, Hey Didhull Didhull, Thecat and Thef Hidhul, ¶XL., pp. 682. Ib.
§ Not found in the MSS. of the 20th century. Hunc Dunc. V Hugo Dusenbury; Sine venire. Puck; vol. XV., pp. 93-87; objected to by the English committee.
¶ This may also be rendered "a long ways."
** In the Vulgate, "like a diamond."—*Burlington Hawk-eye.*

CIVIL ENGINEERS,

At good pay, are wanted on a new road here, E. H. Hyndman, General Manager of the Pittsburg & Western Railroad, wired us on the 24th, from Pittsburg, Pa. Gen. F. H. Smith, Superintendent Virginia Military Institute, writes us, June 29: "Every member of our graduating class wishing to engage in civil engineering, and qualified for it, has been engaged." A correspondent of the State writes that the report of the superintendent of V. M. I. states that he has an application from the chief engineer of a leading Virginia railway for the immediate services of every member of the graduating class qualified to be a civil engineer, and that the Professor of Civil Engineering, Col. W. M. Patton, has a telegram from Texas making the same offer for all civil engineer graduates, at $75 a month. It is evident that the educated men most in demand now are civil, mining and mechanical engineers, geologists, etc.; men who can aid in the development of the resources of the country. We are sorry to see that our colleges and universities are this year furnishing so few of these and so many other, judging by the law of demand and supply, comparatively useless professional men.—*The Virginias.*

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Red Bank, N. J., is at present devising a scheme for obtaining a supply of water.

BRAMPTON, Ont., July 18.—The by-law submitted to the ratepayers here to-day to issue debentures for $40,000 for the purpose of water-works construction was carried by a majority of 168.

The Consolidated Safety Valve Co., of Boston are receiving large orders for their "Pop" valves from California and the mining districts of the West; also from rolling mills and water-works throughout the country.

The Madison City (Wisconsin) water company has been organized with the following officers: President, L. S. Hanks; Vice President, Simeon Mills; Secretary, W. A. P. Morris; Treasurer Frank G. Brown. The amount of stock taken is $25,500.

A lot of boilers are needed for the water-works in Wheeling, and bids were advertised for. Among the bidders were D. W. C. Carroll & Co., of this city. They offered to do the work for $10,912; Cox & Morrison wanted $11,500; A. J. Sweeney & Son, $11,000. When the committee met yesterday to open the bids, Mr. William Russell, representing the Pittsburgh company, was on hand with a sample of the company's work and announced that all the specifications would be met if the contract were given to his company. The committee consulted a while and concluded to hold an executive session on the subject. After remaining in session about half an hour the doors were opened, and it was stated the contract had been given to Sweeney. To say that Mr. Russell was indignant is putting it mildly. He asked the chairman: Was I not told by you that this thing was to be on the square? Was not my bid the lowest? Did you not advertise in the Pittsburgh papers?" All of which being answered in the affirmative, the reason for passing his bid was demanded and it leaked out that the committee was of the opinion that the difference between the bids—$88—was so small that it would be better to keep the money in Wheeling.—*Pittsburgh Telegraph.*

BRIDGES.

The new bridge between Louisville and New Albany now seems about to be a certainty. The survey has been completed, and only awaits approval by the Secretary of War before the work of construction is begun. It will be twenty-five hundred feet long, accommodating railroad trains, street cars and other vehicles and pedestrians. It is to cost $2,500,000, and to be completed within three years. It will be supported by eight piers. The Louisville, New Albany & Chicago and the St. Louis Air Line railroads are to be the principal owners.

The contract for the Canadian Pacific Railway bridge over the River Assiniboine at Brandon has been let to the Toronto Bridge Company, who will have the structure completed and ready for use by the time the rails are laid and the road is ready for traffic between Portage la Prairie and Brandon. An iron traffic bridge, with toll, has been opened over the Assiniboine River, and the contract has been let by the Directors of the Bridge Company, of which C. J. Brydges is President, to build an iron bridge over the Red River, to the Cleveland Bridge Company, for $24,000. It will be opened for traffic in March, 1882.

RAILROADS.

MADOC, Ont., July 18.—The first sod on the line of the new Toronto & Ottawa Railroad was turned here to-day.

A surveying party under Col. Wm. Miller has just completed the location of a line from Sedalia, Mo., to Marshall.

The Nashville, Chattanooga & St. Louis road will build an extension to Sparta, opening the coal fields of White County.

NEW ORLEANS, July 18.—The end of the track on the New Orleans Pacific Railway is eighty miles north of this city, and the work is progressing rapidly.

PORTLAND, Me., July 18.—The preliminary organization of the Bridgeton & Saco Valley Railroad Company was effected Saturday night. It will be a narrow-gauge road, and will connect with the Ogdensburg road at Hiram. Fifty thousand dollars have been raised by private subscriptions, and $40,000 voted by towns.

Articles of association of the Chicago Belt Line Railroad Company of Indiana have been filed with the Secretary of that State; capital stock, $1,250,000; directors, Jonas S. Mickling, Thomas W. Grover, William S. Hineline, Milton Weston and Alfred B. Mason. This is an extension of the Chicago Belt Line, of Illinois, about six miles of which will be in Indiana.

SPRINGFIELD, Ill., July 18.—The Quincy, Vandalia & Eastern Railroad Company to-day filed with the Secretary of State articles of incorporation, with a capital stock of $5,000,000. It is proposed to construct a railway from a point at or near Quincy, in Adams County, to or near Vandalia, in Fayette County, or to or near Greenville, Bond County. The principal business office is to be established at Jerseyville, Jersey County. The incorporators are James L. Pennfield, of Chicago; Geo. Ware and John N. English, of Jerseyville; Wesley Park, of Fulton, and Horatio N. Belt and Royal J. Whitney, of Bunker Hill.

MILFORD, Pa., July 18.—The managers of the Ontario & Western Railroad have in contemplation the building of a branch which will leave the main line near the Shawangunk Tunnel in Ulster County, run down the Neversink Valley, cross the Delaware River into Pike County, Pa., at Port Jervis, N. Y., continue down the valley, along the Delaware, to the coal regions, crossing the Delaware, Lackawanna & Western near Delaware Water Gap. If constructed, this will be the quickest passenger route from Philadelphia to New York and Boston, and by far the best route from the Pennsylvania coal fields to New York City.

The Cincinnati & Ohio River Railway organized in Cincinnati on Saturday last as follows: Directors, A. J. Warner, Marietta; Samuel Thomas, Columbus; Wm. M. Ramsay, John F. Follett, of Cincinnati, and James McArthur, of Chicago. Gen. Warner was elected President and Mr. Ramsay Treasurer. The old Ohio Valley Company have transferred to the new company their rights of way between here and Huntington, and also surveys of the same. The new company are completing the right of way and getting ready for work. The Ohio Valley will build from Bellaire to Huntington, making a continuous line from Pittsburg to Cincinnati on the river bank.

Articles of incorporation of the Jacksonville & Kansas City Railway Company have been filed in Springfield, Ill. The object of this corporation is to construct and operate a road from Springfield through Sangamon, Morgan, Scott, Pike and Adams counties to the city of Quincy via Jacksonville, Winchester and intermediate points. The capital stock is to be $3,000,000 and the principal office at Jacksonville. Among those interested are William S. Hook, Samuel T. Rowley, William E. Veicht, Edward Scott, Henry L. Clay, John Gordon, Edward King and William Brown, of Jacksonville; Charles Frost and James W. Riggs, of Winchester; Scott Wike, of Pittsfield, and Oliver Coultas, of Morgan County, who will compose the first board of directors. It is stated that arrangements have already been completed to build the road from Jacksonville to the Illinois River, just below Winchester.

A RAILROAD ARMY.—"The force of men now at work on the Denver & Rio Grande Railway's extension is larger than the United States army!" The speaker was ex-Governor Hunt, who had just returned to Denver from old Mexico. "How many men are there?" asked a *Tribune* reporter, a little awed by the statement. "More than 32,000," returned the Governor, laconically. "Nearly 19,000 of this number are at work in old Mexico. There are 8,000 or 4,000 in New Mexico, 5,000 or 6,000 in this State, and the remainder are scattered through Utah and the other localities where we are now doing work." "Do you find any hindrances to your work from the people of old Mexico?" asked the reporter, remembering that several correspondents from the old country had recently said that the natives were suspicious of all new railroad enterprises. "The only hindrances we find are in not getting the supplies we need. The people are all right, but timber is so scarce that we have to transport all our ties from Louisiana or Florida. There is a lack of all kinds of railroad material down there—except men to do the work; we can get all of them we want. There is no truth at all in the statements that the old Mexicans regard railroad enterprises with suspicion or that they openly or otherwise oppose them. Why, we are giving bread and butter to 19,000 of their people—something they never had before. They haven't got any very good reason to complain and they don't seem disposed to. I wish the people of other regions we have gone through had treated us as well as they do in Mexico. The leading and influential men do all they can to aid the enterprise, and no difficulty has been experienced in getting all the depot land we wanted donated, and the best kind of title at that. We found it harder to go through Colorado than anywhere else. Even in Leadville we had to pay $100,000 for our depot land." "It has been said by one of the correspondents who was with Grant, that the people of Mexico were not favorable to the United States railroad invasion?" suggested the reporter. "There is no truth in it at all," answered Governor Hunt shortly. "That was most likely said to hurt our road. As I said before, the leading men want the road, the government is glad that it is coming, and why should the people who are making bread and butter by it complain? We will soon have a good deal of road in condition for travel in Mexico," continued the Governor. "We will have 2,400 miles of road in old Mexico, and this, added to that in the States and Territories, will make a total of over 4,000 miles of rail. The work is progressing rapidly, and is being pushed with great energy. Yes," concluded Governor Hunt, "old Mexico is going to be a great railroad country, and it has treated us better than Colorado did."—*Denver Tribune.*

NEW PROJECTS.

Articles of incorporation of the St. Louis, Fort Smith & Southern Railway Company have just been obtained. The incorporators and board of directors are as follows: C. W. Rogers of St. Louis; John O'Day, James Dun and D. H. Nichols, of Springfield, Mo.; A. M. Wilson and B. R. Davidson, of Fayetteville, Ark.; W. M. Fishback, J. B. Baissolara and B. T. DuVal, of Fort Smith, Ark. The capital stock of the new company has been placed at $2,500,000, the actual cost of the construction of the proposed line of railroad. It is divided into 25,000 shares of $100 each. The road will commence at or near the city of Fort Smith, in Sebastian County, Ark., and proceed thence southwardly in and through the counties of Sebastian, Logan, Scott, Polk, Howard, Sevier, and Little River, to a point on the Red River, somewhere in the vicinity of Texarkana, or possibly to that place. This is to be another branch of the St. Louis & San Francisco Railway, and will constitute the first section of the line which that company contemplates building in the future to the city of New Orleans.

CONTRACTING, MISCELLANEOUS, ETC.

An independent cable is to be laid from Germany to Valencia, and thence to the United States. The enterprise is undertaken by the German Telegraph Company and the German Union Company, and will entail a cost of £165,000.

The Railway Improvement Company have just closed a contract with Cofrode & Saylor for the superstructure of the Atchafalaya Bridge, Louisiana, for $63,000. This includes the draw of 300 feet, with the engine for turning it, and two spans of 250 feet each. The work is to be finished in five months from Aug. 1.

We learn from the *Contract Journal* of London that there will be an International Congress of contractors held at Liége on July 24, 25 and 26. In connection with the congress there will be an exhibition of machinery, engines, improved tools and building materials.